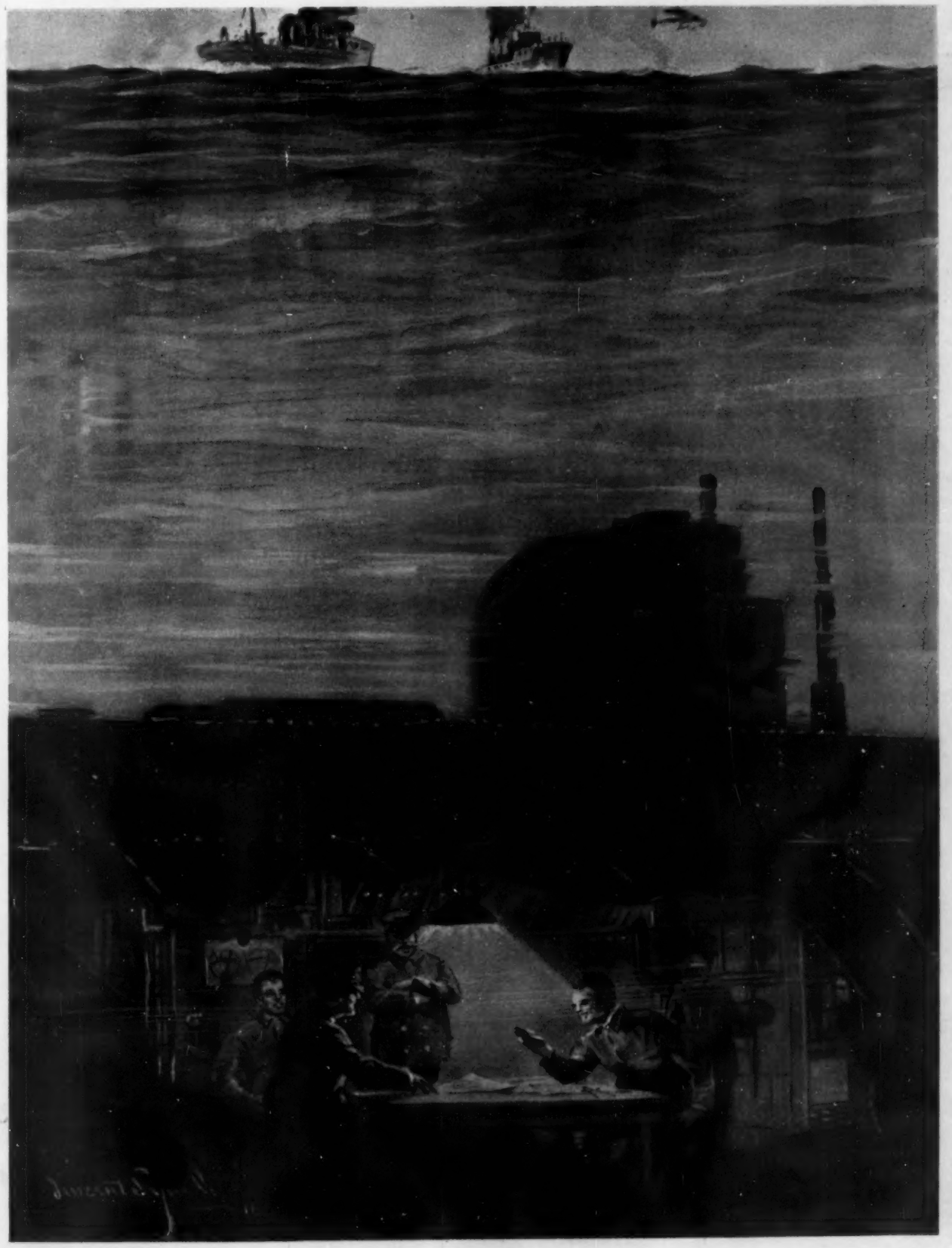
Mrs Bates

SCIENTIFIC AMERICAN

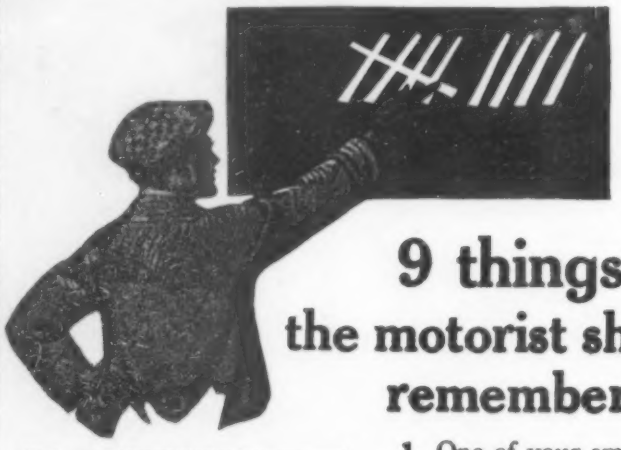


COMFORT ON THE OCEAN BOTTOM

August 12, 1916

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents



9 things the motorist should remember

Correct Automobile Lubrication

Explanation:—The four grades of Gargoyle Mobiloils, for gasoline motor lubrication, purified to remove free carbon, are:

Gargoyle Mobiloil "A"
Gargoyle Mobiloil "B"
Gargoyle Mobiloil "E"
Gargoyle Mobiloil "Arctic"

In the Chart below, the letter opposite the car indicates the grade of Gargoyle Mobiloils that should be used. For example, "A" means Gargoyle Mobiloil "A." "Arc" means Gargoyle Mobiloil "Arctic," etc. The recommendations cover all models of both pleasure and commercial vehicles unless otherwise noted.

MODEL OF CARS	1916	1915	1914	1913	1912
Abbott Detroit (8 cyl)	Arc	Arc	Arc	A	Arc
Apperson (8 cyl)	Arc	Arc	Arc	Arc	Arc
Auburn (4 cyl)	A	A	A	A	A
Auburn (6 cyl)	Arc	Arc	Arc	Arc	Arc
Autocar	A	A	A	A	A
Avery (Mod. 30C, 2 Ton)	A	A	A	A	A
Briscoe (8 cyl)	Arc	Arc	Arc	Arc	Arc
Buick	A	A	A	A	A
Cadillac (8 cyl)	Arc	Arc	Arc	Arc	Arc
Carter Car Con't	A	A	A	A	A
Case	Arc	Arc	Arc	Arc	Arc
Chalmers	A	A	A	A	A
Chandler 7m	Arc	Arc	Arc	Arc	Arc
Chase (air)	B	B	B	B	B
Chevrolet	Arc	Arc	Arc	A	Arc
Cole (8 cyl)	Arc	Arc	Arc	Arc	Arc
Cunningham	A	A	A	A	A
Daimler-Belgian	B	A	B	A	B
Detroit Electric	Arc	Arc	A	Arc	Arc
Dodge	A	Arc	E	E	A
Empire	Arc	Arc	Arc	Arc	Arc
Federal	Arc	Arc	Arc	Arc	Arc
Fiat	B	A	B	A	B
Ford	E	E	E	E	E
Franklin	A	A	A	A	A
Grant	A	Arc	Arc	Arc	Arc
Haynes (12 cyl)	A	Arc	A	Arc	A
Hudson Super Six	A	A	A	A	A
Hupmobile	A	Arc	A	Arc	A
I. H. C. (air) (water, 2 cycle) (water, 4 cycle)	A	A	B	A	B
Interstate	A	A	A	A	A
Jackson (8 cyl)	Arc	Arc	Arc	Arc	Arc
Jeffery (Chesterfield) Com'l	A	A	A	A	A
Kissel	A	A	A	Arc	Arc
Kissel Com'l	E	E	E	E	E
Kelly Springfield	A	A	A	A	A
King (8 cyl)	A	A	A	Arc	A
King Com'l	A	A	Arc	Arc	
Kissel Car Com'l	Arc	Arc	Arc	Arc	Arc
Kissel Car (Model 48)	A	A	A	A	A
Kline Kar	Arc	Arc	A	Arc	A
Knox (Model 36)	B	A	B	A	B
Locomobile	E	E	E	E	E
Lozier	A	Arc	A	Arc	A
Marion	A	Arc	Arc	Arc	Arc
Marmon	A	A	A	Arc	A
Maxwell	Arc	Arc	Arc	Arc	Arc
Mercer (22-70) (35-72)			A	Arc	A
Moon	A	A	A	Arc	A
Mitchell (8 cyl)	A	Arc	A	Arc	A
Moline Knight (6 cyl)	A	A	A	A	A
Moon (4 cyl) (6 cyl)	Arc	Arc	Arc	Arc	Arc
National (12 cyl)	A	Arc	A	Arc	A
Oakland (8 cyl)	Arc	Arc	Arc	Arc	Arc
Oldsmobile (8 cyl)	Arc	Arc	Arc	Arc	Arc
Overland Packard (12 cyl) Com'l	A	A	A	Arc	A
Paige (6 cyl) (6-56 & 58)	Arc	Arc	Arc	Arc	
Pathfinder (12 cyl)	Arc	Arc	Arc	Arc	Arc
Peerless (8 cyl)	Arc	Arc	Arc	Arc	Arc
Pierce Arrow Com'l	A	A	A	Arc	A
Premier	A	Arc	A	Arc	A
Pullman	Arc	Arc	Arc	Arc	Arc
Regal (8 cyl)	A	A	Arc	Arc	Arc
Renault	A	Arc	A	Arc	A
Rac	A	Arc	A	Arc	A
Richmond	Arc	Arc	A	Arc	A
S. G. V.			A	Arc	A
Saxon	E	E	E	E	E
Scripps Booth (air) (water) (8-cyl)			E	E	B
Selden	A	Arc	A	Arc	Arc
Simplex	A	A	Arc	Arc	Arc
Stearns Knight (6 cyl)	B	A	B	A	B
Stevens Duryea			Arc	Arc	Arc
Studebaker	A	Arc	Arc	Arc	A
Stutz	A	A	A	A	A
Velie (4 cyl) (6 cyl)			A	Arc	A
White	Arc	Arc	Arc	Arc	Arc
Willys Knight	B	A	B	A	A
Winton	Arc	Arc	Arc	Arc	Arc

Electric Vehicles—For motor bearings and enclosed chains use Gargoyle Mobiloil "A" the year round. For open chains and differential, use Gargoyle Mobiloil "C" the year round. Exceptions—For *winter lubrication* of pleasure cars use Gargoyle Mobiloil "Arctic" for worm drive and Gargoyle Mobiloil "A" for bevel gear drive.

1. One of your smallest expenses—lubrication—is your chief safeguard against your heaviest expense — depreciation.

2. Friction is relentless.

The effects of the incorrect oil will not be apparent during the first piston stroke or the second. But when piston strokes run up into the millions—and that does not take long—friction begins to get its due. You need not *look* for the effect of wear then. You can *hear* it.

3. Worn motors never "come back."

4. If given intelligent care and scientific lubrication, your car should run better the 2000th mile than the first.

5. No matter how freely a low quality or wrong-bodied oil is used it can never do the work of the correct lubricant.

6. No one oil will suit all cars. This is absolute.

7. You selected a car that suits you. Now select an oil that suits your car.

8. Though you may *want* correct lubrication, you will seldom stumble on it by chance.

9. The Lubrication Chart, printed in part on the left, was prepared only after an engineering analysis of every American car and the leading foreign makes. It is revised yearly to include each season's new models. It represents our professional advice and specifies the correct oil for your car.

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Infantile Paralysis Emergency

10,000 little children and their mothers have been closely confined in their stifling tenement homes in the heat of mid-summer by quarantine or in fear of the disease.

Health Commissioner Emerson says:

"One of the best things the New York Association for Improving the Condition of the Poor can do to co-operate in the effort to control the epidemic of infantile paralysis is to extend its fresh air work at Sea Breeze for the children of the tenements."

To meet the situation, Sea Breeze has been enlarged and will extend its season as late as possible into the Fall.

"Gee, but it's great at Sea Breeze"

Will you send some of these mothers and children to

SEA BREEZE

Cool—Restful—Health-giving

Allow 50 cents a day or $3 a week for each one you will send as your guest and make the amount payable to George Blagden, Treasurer.

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SEVENTY-SECOND YEAR

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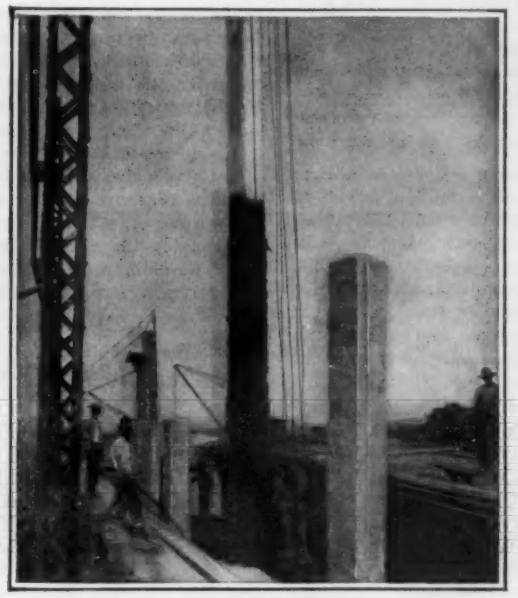
Concrete Piles in Salt Water

By F. J. Springer

THERE can scarcely be any doubt but that engineering practice in general tends in the direction of establishing foundations upon bedrock. In illustration, it may be pointed out that nearly all the very tall structures in New York stand on rock, and rock only. Concrete piers founded on rock extend upward to the footings or other supports. However, there is a very considerable percentage of cases where either the expense or the engineering difficulties exert a prohibitive influence, with the result that the structure must be set upon something not so stable.

Driving an oblique pile



Driving piles of great length

The bearing pile is the engineer's reliance in a large proportion of such cases. This is an old and thoroughly tried thing. Where conditions are favorable, it meets the case very well indeed.

A bearing pile performs its functions largely because of the friction between its lateral surface and the contacting soil. There is, however, a certain amount of support supplied by the sustaining power of the soil exerted at the very bottom and, if the pile is tapered, by the resistance to displacement of the soil surrounding the main body. If the conditions under which a pile is placed are such that the load is sustained solely by the supporting power of the soil beneath the foot, then the pile has ceased to be a pile and has become a pier. Such a case would exist where the pile is put down through fluid mud to a hard bottom. A pile might here fail that under other conditions would succeed. A pier has to resist the tendency of its own body to buckle.

The principal method employed in putting down piles proceeds by a driving action of the same general character used by us in driving a nail with a hammer. This procedure is applied to concrete piles as well as to wooden ones. Naturally, concrete is rather ill adapted to withstand sudden and violent shocks; but the head may be greatly strengthened by steel reinforcement and the hammer blow may be cushioned. At all events, concrete piles are being successfully driven.

The wooden and the concrete pile both have their fields of usefulness, and these fields naturally overlap to some extent. If a wooden pile is to be continually submerged it has ordinarily an indefinite life before it, in so far as deterioration from the weather is concerned. In some waters, particularly southern ones, the *teredo* is a very great enemy of the wooden pile. The teredo, and possibly other borers, are driving the wooden pile from the San Francisco waterfront. The concrete pile, on the other hand, has nothing to fear from such sources. The chief question in salt water relates to the possibility that perhaps chemical actions and reactions may take place between the substances in the concrete and those held in solution in the sea water. Whatever activity of this kind may be possible, it can probably be largely eliminated or modified by the use of the cements most highly approved for salt water and by making the concrete a very rich mixture.

The borers do not confine their activities to low latitudes. They were to be feared even at Halifax and constituted one of the reasons for the rejection of wooden piles and the choice of reinforced concrete ones for the pier construction at Deep Water, within the city limits. There is rock beneath mud, gravel and hardpan, but it is 67 feet down at the outer end of Pier 2, the first to be constructed, and 44 feet at the shore. The pier is 686 feet long, 235 feet wide, and carries a heavy two-story shed. The great weight which had to be supported seems to have been another reason for the selection of reinforced concrete piles. The average vertical distance from track level on the pier to rock is about 75 feet.

The rock is overlaid by a stratum of gravel and hardpan, but only to a moderate depth. As only soft mud and water was above this layer, the effect of driving a pile through the gravel and hardpan down to rock would be to create a combination of a long pier superposed upon a short pile. In order to lengthen the pile portion, a stratum of dredged material was deposited on the site, thus thickening the stratum of solid soil.

(Concluded on page 159)

A nest of piles; hoisting crane in background

Swinging a big pile into position

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

The Naval Bill

THE country-wide agitation for an immediate increase in our naval strength has found an adequate response in the excellent bill passed by the Senate with a vote of seventy-one to eight. The new program calls for the construction of 157 vessels, including sixteen battleships and battle-cruisers, within three years, at a cost of $588,180,576. Of this sum, $110,726,160 is to cover the first year's building expenditures. The total sum carried in the bill is $315,000,000.

The measure passed a few weeks previously in the House made no provision, as does the Senate bill, for a continuing building program, and it comprised only 72 ships. Included in these were five battle-cruisers, but no battleships. The two programs will now have to be thrashed out in a conference committee, and it is the belief in Washington that at least four battle-cruisers and two dreadnoughts, the construction of which is to commence at once, will be agreed upon.

Now, in all the recent agitation throughout the country for the upbuilding of our Navy, the public-spirited laymen who have been responsible for the movement very wisely refrained from making any suggestion as to what types of ship and how many of each should be added to the Navy, and urged that it was the duty of Congress to accept the proposals of its naval experts as embodied in the recommendations of the General Board of the Navy. The House bill ignores this suggestion, but the Senate has met the situation by adopting the program worked out by the Navy General Board—a program which was drawn up with the avowed intention of restoring us to that position of second naval sea-power which we held ten or a dozen years ago.

The bill authorizes the President to undertake, prior to July 1, 1919, the construction of 10 first-class battleships, 6 battle-cruisers, 10 scout cruisers, 50 destroyers, 9 fleet submarines (that is to say, submarines of sufficient size and speed to accompany the fleet wherever it may go upon the high seas), 58 coast submarines, and 13 auxiliary and miscellaneous vessels. By the provisions of the bill 4 battleships, 4 battle-cruisers, 4 scouts, 20 destroyers, 30 coast submarines, and several auxiliary vessels are to be contracted for or begun within six months of the day on which the President shall sign the bill.

Now, in view of the fact that it takes three years to build a capital ship and that the last ships called for in the Senate bill will not be laid down until 1919, it is evident that the program cannot be completed before 1922. Furthermore, it takes fully a year of fitting out, drilling, etc., to bring a battleship into effective fighting condition; hence, it will be seven years from now before the proposed addition to our fleet is in a condition to go into battle. These facts, if viewed in the light of our present relatively weak condition among the leading navies of the world, ought to convince any thoughtful mind that the Senate bill, so far from being extravagant, makes no more than a conservative provision for the future.

Limitations of space prevent any detailed reference to the minor provisions of the bill; but it is gratifying to note that $135,000 is to be devoted to the provision of prizes, trophies and badges for excellence in gunnery and engineering exercises, and for the printing and publishing of the results obtained. For the erection of a projectile plant, $705,611 is proposed. Also, $11,000,000 is asked for the erection of an armor plant with a capacity of 20,000 tons per annum—a doubtful experiment, which will work an unquestionable hardship on the large existing private plants. Our ships will not be short of shells if the proposed sum of $13,720,000 for projectiles, etc., be voted. Interesting is the fact that $480,000 is asked for torpedo nets and equipment.

The navy yards are dealt with generously, particularly those which lie south of the Mason and Dixon line. We believe that the bulk of this money could be better spent on the improvement and enlargement of a few of our leading yards.

The Experimental and Research Laboratory gets $1,500,000.

The bill provides for a full manning of the fleet and also for a badly-needed reserve. In this connection we are glad to note that the bill contains evidence of a full recognition of the value of the voluntary services of the vast body of yachtsmen, whose numbers have so greatly increased during the past few years on both the Atlantic and Pacific coasts. The attitude of Congress is one of decided appreciation and encouragement—thanks largely to the effort of our able Assistant Secretary of the Navy, Franklin D. Roosevelt. As an instance of this, we note with pleasure a clause in the bill by which the Secretary may sell lubricating oil and gasoline to vessels of the Volunteer Patrol Squadron, and that during maneuvers or practice drills carried on under the command or control of officers of the United States Navy, gasoline shall be supplied to the vessels free of charge.

The ultimate fate of the Naval Bill depends very largely upon the action of the President of the United States. We have reason to believe that his attitude toward the question of naval increase is strongly favorable. If the Senate's proposals should receive, as we believe they will, his earnest indorsement, the restoration of our Navy to its former and proper position of second in strength may be looked upon as well assured.

The Progress of "Daylight-Saving"

NOTWITHSTANDING the fact that the greater part of Europe has tentatively put in operation the plan of keeping the clock an hour ahead of standard time during the summer season, the merits of the project are still a subject of lively controversy. The actual change appears to have been effected in the countries concerned without serious inconvenience or confusion. The process of adjustment to the new system has, however, presented some unexpected features. For example, certain English electric lighting companies have indemnified themselves for the diminished consumption of electricity which the scheme is supposed to entail by the simple expedient of increasing the price of current.

As was foreseen before the plan was adopted, it has not been possible to change the real time of all human activities in consonance with the change in the clock. Thus, agricultural work is necessarily regulated by daylight, without regard to conventional timekeeping. It is not feasible, for instance, to begin cutting hay in the morning at an hour when the grass is still heavily laden with dew. Indeed, it is inevitable that under any system which involves the alternate advancing and retarding of the clock, a large percentage of the population would be under the necessity of changing the *nominal* and preserving the *actual* hours of their daily routine—just the reverse of the result which the daylight-saving plan seeks to attain. How large a proportion of the community would be affected in this paradoxical way is not yet clear. Opponents of the new system claim that the proportion really amounts to a majority, and that the plan is designed to benefit city dwellers at the expense of the rural population.

Whatever may be the future history of the daylight-saving plan, it has certainly furnished an interesting example of a situation in which, since the doctors disagree, a decision must await the results of practical experience. The divergency of authoritative opinion on the subject is illustrated in the report of a recent meeting of the Astronomical Society of France, which was devoted entirely to a discussion of the new system of timekeeping. The advocates of the plan, headed by M. Flammarion, insisted that it was to be judged only with reference to its practical merits, and that its scientific aspects were unimportant. Science will continue to use whatever kind or kinds of time are best adapted to its needs. Opponents of the plan laid stress upon the fact that there is a certain large borderland between scientific and practical affairs in which a diversity of timekeeping may lead to serious confusion. The hours of tidal phenomenon, for instance, are published, for France, in Greenwich time, and a mistake of an hour might easily result in the stranding of a vessel. This is equivalent to saying that when two kinds of time are used instead of one, extra alertness is necessary if errors are to be avoided. The argument is not a weighty one, because the concurrent use of two or more kinds of time is already exceedingly common, and the process of conversion from one to another is generally familiar.

In England the Summer Time Act was amended at the last moment so as to exempt the meteorological service from its operations. Astronomy and navigation were exempted in the original bill. Meteorology has always suffered from the existence of diverse systems of timekeeping, and the new plan will probably not add seriously to the confusion; indeed, it may even prove beneficial, if it results in more pains being taken to indicate, in connection with the records of meteorological observations, what kind of time is used therein—whether standard, local, or "summer" time.

Probably the most remarkable feature of the discussions heretofore recorded on the subject of daylight-saving is the fact that both advocates and opponents of the plan persist in regarding it as a species of "deception," and emphasize its psychological mode of operation. Properly considered, the device of altering the clock is not intended to deceive anybody, but is simply a short-cut to bringing about a great number of changes at one time. It is easier to change the clock than to change railway time-tables, announcements of opening and closing hours in shops, factories and offices, and a great variety of other time schedules. The real question at issue is not whether it is desirable to substitute a new artificial system of timekeeping for an old and equally artificial one, but whether it is desirable for the bulk of the population to keep earlier hours—either in summer or all the year round—than they keep at present.

In the United States the daylight-saving plan has been adopted only to the extent of employing in certain towns near the boundaries of the standard time zones the time of the next standard meridian to the east in preference to that of the one to the west. This results in the keeping of earlier hours throughout the year, and not in adapting the time to the season.

The adoption of a national daylight-saving law has been considered, but appears to be impracticable, for the reason that the federal government has no jurisdiction over the systems of timekeeping employed in the several states.

The Health of the Nation

THE loss of a steamship in mid-ocean, involving the sudden death of a thousand or more human beings, is a distressing event. The bloodshed and devastation entailed by the unprecedented war now raging in Europe fill us with horror. Yet in comparison with tragedies that are being enacted in our own country, and that could be prevented by the thorough awakening of the public conscience in regard to them, the worst shipwreck on record is absolutely insignificant, and the great war in Europe is of only secondary importance. This is an incontrovertible fact; it has, in one form or another, been frequently stated; yet preventable diseases and accidents continue to take their huge toll of human life among us, besides imposing prolonged suffering upon millions of our people, and depleting the wealth of the nation. Here is a subject demanding the attention of the Government far more urgently than that of military preparedness with which it is now so conspicuously occupied.

Moreover, the two subjects are not unrelated to each other, since improving the physique of its citizens is one of the best ways in which a nation can prepare for war. This generally neglected aspect of the problem of national defence was emphasized by Mr. E. E. Rittenhouse in his notable address as vice-president of Section I of the American Association for the Advancement of Science at the meeting in Columbus. Mr. Rittenhouse suggested that Congress empower the President to appoint a "national vitality commission" to study and report upon the present physical status and trend of our population. No such commission is, however, needed to demonstrate in a general way the fact that an appalling amount of preventable ill-health and physical inefficiency prevails among us. The character of our civilization tends to make us weaklings. Science has greatly diminished germ diseases, but organic diseases are rapidly increasing.

One of the hopeful signs that an era of more active measures in behalf of public health is approaching in this country may be found in the impetus recently given to the project of state insurance against sickness. A committee of the American Association for Labor Legislation recently drew up a model bill for the compulsory health insurance of wage-earners, and this formed the basis of a bill introduced in the New York Legislature on January 24th by Senator O. L. Mills. The proposed law closely resembles that recently adopted in Great Britain. Every wage-earner whose income does not exceed $100 a month will be entitled to the services of a physician when he is ill, will receive an allowance during disability up to a period of six months, and will be provided with such medicine and surgical appliances as he may require. Death and funeral benefits are also included. The expense of the undertaking is to be divided between workers, employers and the state.

Advocates of this form of social insurance argue that it will not only mitigate the effects of ill-health, but also prevent a great deal of serious sickness, because the poorer classes will no longer be deterred by financial considerations from consulting a physician at the outset of a malady.

Electricity

Electrical Treatment of Timber.—Of interest is a method of treating timber electrically which is being developed in England. When current is passed through freshly cut timber a chemical change is said to occur, which renders it more able to withstand attacks of fungi. A few hours' treatment by one of the methods is claimed to have an effect equal to months of ordinary drying in free air. Inasmuch as moisture assists the flow of current, the process is best applied when the tree has just been felled. From 3 kw. to 6 kw. of current is required per cubic meter.

A Coin-Operated Electric Fan.—There is now available an electric fan which can only be operated by placing a coin in its slot, whereupon it operates for a certain length of time, according to the amount of current which the owner desires to supply for the money paid. When a coin is dropped into the slot, a clock mechanism is wound up in the base of the fan. For a nickel, for instance, the fan may operate one hour, either constantly or intermittently, according to the wishes of the user. Several coins can be dropped in at one time, insuring several hours' use of the fan.

Handy Plaster Drill for Electricians.—There has lately been introduced an adjustable plaster drill which can be used to cut plaster or wood on ceilings or walls where concealed work is required and outlet boxes must be inserted flush with the surface. The drill consists of two outer knives which move edgewise to the work, two heavy knives which move side on, and a center pin. The knives may be adjusted to cut any sized hole from 3 to 4 inches. Below the knives is a bowl which serves to catch the material taken out by the cutting members, preventing it from falling into the eyes of the workman when using the drill on a plaster or wood ceiling. The entire drill is made in one piece, terminating in a shank, which is held by the bit of the brace in the usual manner.

Electrical Production of Copper.—According to *Electrical World*, the Anaconda copper mine, which today is producing the red metal at the rate of 330,000,000 pounds annually, will by the end of 1916 be using electrical energy at the rate of 700,000,000 kw.-hr. annually, or at the rate of about 2 kw. per pound of copper produced. Applied to all the power needed for mining, reduction and transportation operations, electrification has meant a saving to the Anaconda of from $3,500,000 to $4,000,000 annually, as against what could be done with steam power under present conditions and at the present rate of operation, and much more as against what was done with the isolated steam plants in use before electricity was substituted. Applied to the present rate of production, this means a saving of somewhat more than 1 cent per pound.

A Novel Lamp-Filament Breaker.—The Boston Edison Company has developed a novel device for destroying lamp filaments in discarded lamps. To prevent unsatisfactory lamps from finding their way back into service, the company renders such lamps absolutely unserviceable by destroying the filaments. The present device consists of a powerful electromagnet with U-shaped core, having a winding of 55 pounds of No. 16 cotton-covered copper wire. The gap in the core is sufficiently large to admit all lamps up to those of 250-watt size. Within the gap formed by the magnet core is arranged a quick-acting lamp socket, supplied by 220-volt alternating current through a resistance. The purpose of the resistance is to prevent a heavy flow of current should any of the lamps have defective bases or develop a short-circuit in the breaking of the filaments. In operation, the direct current is left on continuously in the magnet winding. The lamps which are placed in the socket between the legs of the magnet are almost instantly shattered as soon as the current passes through them by the violent action of the magnetic flux.

A Lock for Incandescent Lamps.—In the form of a tungsten lamp having a locking base, an electrical manufacturer is now offering a distinct innovation. Once inserted and screwed into place, the locking arrangement becomes automatically operated. The mere act of screwing the base into the socket locks the lamp. If turned in the reverse direction the lamp simply revolves within the outer shell without result. Heretofore practically all devices designed to prevent the unauthorized removal of lamps have depended upon some key-locking arrangement, which was frequently overlooked or forgotten. The effectiveness of the present lamp base is not subject to the element of human forgetfulness, as it must be locked to light, and vice versa. The lamp was not designed for use in the home nor in places where lamps are frequently removed to permit the insertion of some form of current consuming device. It is more specifically intended for use in public buildings, railway stations, hotels, etc., where the unauthorized removal of lamps is prompted either by the desire to steal or to use the current for other purposes without authority.

Science

Radio-active Waters in Japan.—Investigations of the hot and mineral springs of Japan with a view to determining the quantities of radium they contain have led Dr. Ishidzu, of the Tokyo Hygienic Laboratory, to declare that Japan is the richest country in the world in radium-bearing waters.

Growth of the Tilefish Fishery.—The efforts of the U. S. Bureau of Fisheries to add tilefish to the American dietary have met with great success. Prior to October, 1915, this fish was practically unknown in the markets. During June, 1916, the receipts at New York amounted to 1,126,000 pounds. The total sales of tilefish since this fishery was established were more than four million pounds up to June 30, having a first value exceeding $200,000.

The Artificial Dispersion of Fog.—The last report on the explorations and field-work of the Smithsonian Institution reviews the progress of the experiments, previously noted in these columns, which a committee of electrical engineering experts is carrying on in California on the dispersion of fog by electrical precipitation (the Cottrell process). During the past year great improvement was made in the technique of the process, but the days of suitable fog conditions were scarce. On the rare occasions of actual trial very perceptible clearing for a short distance around the high tension wires was obtained as the fog swept past.

A Porto Rican Dye Plant.—In view of the present scarcity of dyes, some interest attaches to the receipt by the Bureau of Foreign and Domestic Commerce, in Washington, of samples of the fruit of the *vijao* plant, which grows wild over a large part of Porto Rico and is used by the natives as a source of dye and ink, said to be quite fast. The plant has been identified as *Renealmia exaltata*. Last December, seeds of the same or a very closely allied species were received by the Bureau of Plant Industry from Brazil, with the name *papatinga* attached, and the information that they are used as a dye in that country. A recent consular report also states that *Renealmia exaltata*, popularly known as *fructos de pacova*, is found throughout Brazil and furnishes a red dye of exceptional fastness.

Trichinae in Inspected Pork.—A report of the Public Health Service corrects the erroneous idea entertained by many people that pork which has passed the government inspection is necessarily free from trichinæ. There is no known method of inspection which makes it certain that these parasites are not present in uncooked and otherwise untreated pork. Moreover, it is believed that more than 14 out of every 1,000 hogs slaughtered in this country contain trichinæ. The parasites may be destroyed by prolonged exposure to extreme cold and by certain special methods of curing; but these processes are not generally applicable, and the one practical safeguard against the dreaded disease trichinosis is thorough cooking of pork, whether fresh or cured.

The Kara Sea Wireless Stations.—An article by V. A. Tarasoff, published in the *Wireless World*, describes the three radiotelegraphic stations erected by the Russian government in the Kara Sea region for the purpose of giving notice to mariners of the condition and movement of the ice, thus facilitating navigation from Europe to Siberia. The stations are at Yugor Straits, Vaigach, and Cape Mare Sale (135 miles southeast of the Yugor station). The first two are provisioned for 14 months, and the last, access to which cannot be depended upon every year, for 28 months. The employees of the stations add to their larder by hunting. Besides books and games, each station is supplied with a gramophone, with fifty records, and numerous other musical instruments.

Hail Insurance in America.—Though insurance against damage by hail is very commonly practiced over the greater part of Europe, it is comparatively rare in the New World. The provincial government of Alberta, Canada, inaugurated a system of hail insurance some years ago, and in 1913 a similar enterprise was undertaken by the province of Saskatchewan. The state of North Dakota provided hail insurance for its farmers as early as 1911. In 1913 the rate of premium under the state scheme was increased from 20 to 30 cents an acre and an official adjuster was appointed in each county. The rate applies to grain crops of any kind, and there is no limit to the amount of insurance that is accepted in a given section or township. The commercial companies protect themselves from the results of severe hailstorms of local extent by limiting the risks accepted in any one region, and they also charge higher premiums in the western than in the eastern part of the state. The whole business of hailstorm insurance is still in a tentative state in this country, as statistics of hail damage are at present inadequate to furnish a sound actuarial basis for such business.

Aeronautical Notes

A Model Aeroplane Competition is announced by the Aero Club of America, in which prizes amounting to $695 are to be offered. The contests are to be restricted to small model aeroplanes driven by compressed air instead of those driven by elastic bands.

Austrian Troops Fed by Aeroplane.—It appears that the aeroplane has again been called into service to supply food to beleaguered troops. The first important instance was during the siege of the British force in Kut-el-Amara. According to a correspondent of the *Corriere d'Italia*, two regiments of Jaegers, finding themselves besieged in the Frezela Valley, were furnished with food from aeroplanes.

French Airmen on Russian Front.—Correspondents of Berlin papers on the Russian front lay more and more stress on the large numbers of French airmen and machines with the Russian forces. It has been reported on more than one occasion that the French aviators who recently arrived in Moscow are now flying on the Galician and Volhynian fronts, while several hundred French aeroplanes are reported to have arrived along the whole Russian line.

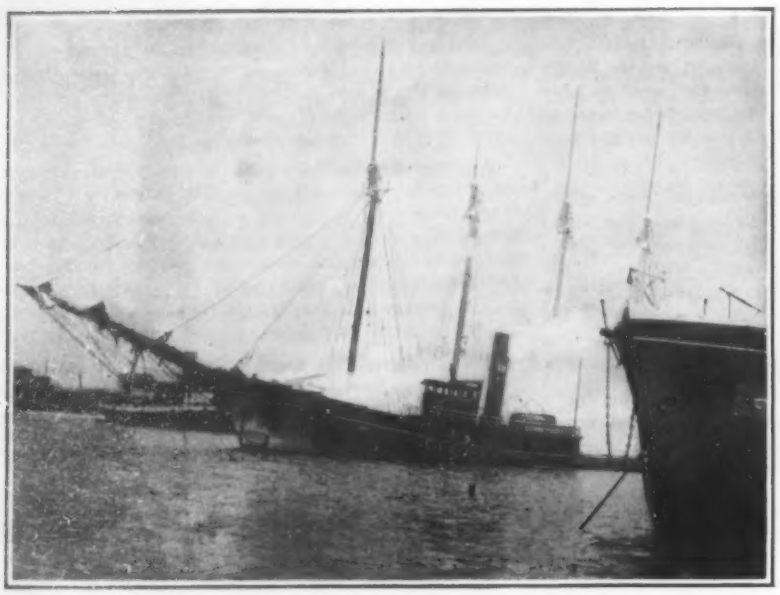
An American "Canard" Type Monoplane.—There has been developed by George D. White of Los Angeles, Calif., a unique type of monoplane of the canard design; that is to say, it is of the tail first type. It is driven by an ordinary twin-cylinder motor cycle engine which turns a 5 foot 3 inch propeller at 1,500 revolutions per minute, giving the machine a speed of 50 miles per hour in the air. The span of the single main plane is 18 feet, with a chord of 5 feet. The total weight is 230 pounds. The pilot sits somewhat in front and below the main plane, much in the same manner as in the Demoiselle monoplane of pioneer days and the more recent Train monoplane.

An American Self-Starter for Aeroplane Engines based on the employment of compressed air has recently made its appearance. To start an engine with this form of starter, air contained in a tank is drawn through a control valve to a special carbureter, where it picks up gasoline in a thoroughly vaporized form. Through an automatic distributor the compressed gas is fed to the engine cylinders in firing sequence. The compression is sufficiently high to cause the first piston—that on the compression stroke—to move downward, the spark takes place, and the motor is soon turning over at its normal speed. Compressed air is stored in the air tank by means of a small compressor driven by the aeroplane engine.

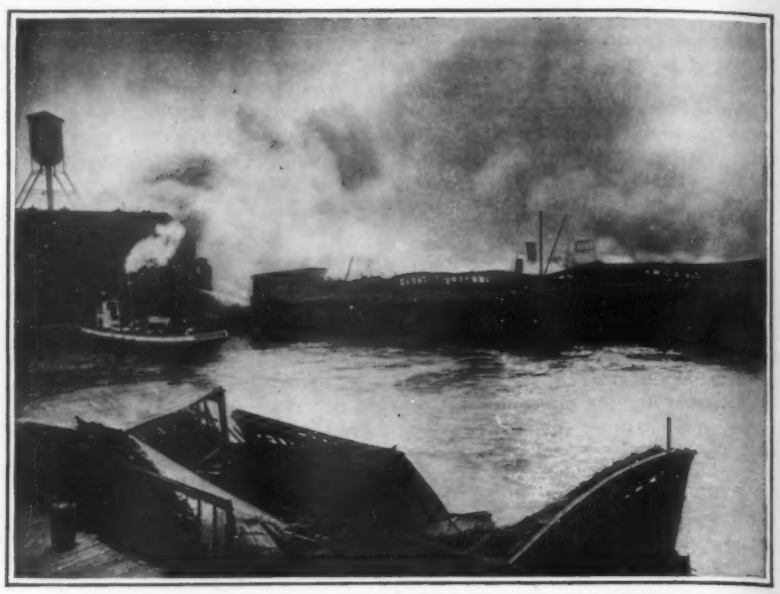
Caproni Biplanes of the Italians.—The Caproni biplanes, which have been frequently mentioned in the aerial activities of the Italian forces, are fitted with three engines of 100 horse-power each. One of these is mounted in the central nacelle and drives a propeller, while the other two are placed on the lower plane, on either side of the central engine, each driving a tractor screw. Running back from each of the side engines is a fuselage shaped structure which serves to support the tail member some distance in the rear of the biplane, and to stream-line the engine. The nacelle is provided with seating accommodations for the crew, comprising a pilot and two gunners. Because of their great weight-carrying capacity, the Capronis have been found particularly suitable to bomb-dropping raids.

Metal Propellers for American Machines in Mexico.—The use of aluminum alloy blades in the place of wooden propellers on aeroplanes subjected to the terrific heat conditions in Mexico and along the border is being considered at present by American aviators. As previously reported in the columns of this journal, the Army airmen have experienced no end of trouble with wooden propellers on the machines of the expeditionary forces. The propeller that is to be tried out soon is made of an alloy whose base is aluminum. It is planned to cast the alloy in block form and then tool it to the shape of the propeller blade. The core thus formed will be covered over with light sheet-steel. A propeller made after this fashion will be lighter than the present wooden ones and will not splinter.

French Aviator Over Berlin.—The flight of Antoine Marchal, an aviator in the French army, is unique in many ways. First of all, he captured the world's record for a non-stop flight by flying 807 miles, from Nancy to Cheim, Russian Poland, by way of Berlin. His mount was a special weight-carrying Nieuport monoplane. The second point is that in passing over the German capital he released large numbers of proclamations, which, needless to state, were far more impressive on the German minds than if he had dropped explosive bombs, resulting in great loss of life in the crowded city. Third point, his capture when within 60 miles of the Russian lines must have been a great blow to the aviator, who, after landing to change two of the spark plugs of the engine, discovered two more plugs that needed changing. It was while changing the latter that he was captured by Austrian soldiers.



Extinguishing fire on a four-masted schooner



Scene at 5 a. m., about two hours after the great explosion

The Munitions Explosion in New York Harbor

A Great Disaster Accompanied with Comparatively Little Loss of Life

IT is a strange anomaly that what is probably the greatest explosion connected with the European war should have taken place in the port of New York. But so it is; for we doubt if anywhere upon the battlefields of Europe it has happened, either by intent or by accident, that 275 tons of high explosive has been detonated at one time. The nearest approach to this has occurred when artillery or a bomb-dropping aeroplane has blown up an ammunition depot, or when a retreating army has destroyed its stores of ammunition.

That the casualties were so few—about half a dozen lives having been lost—is due to the fact that the pier of the Lehigh Valley Railroad, at what is known as Black Tom Island, where the munitions are transferred from rail to barge, is located some two miles from any habitation. Had this enormous explosion occurred at a pier located, as is often the case, in or near a populous district, the loss of life would have been appalling.

New York is the principal point of shipment for the vast amount of munitions, amounting in value already to between $300,000,000 and $400,000,000, which is being manufactured in the United States for the Allies, and shipped to Europe as fast as it is completed. As soon as a shipment of shells, powder, etc., reaches New York, it is transferred to barges and lighters, which are towed out to the steamships which, for safety, are anchored in Gravesend Bay.

On the night of July 30-31 there was a heavy consignment at the Lehigh Valley pier, consisting chiefly of 3-inch and 6-inch shells and high explosives. The shells, largely shrapnel, were loaded—black powder in the base; balls packed in place; and time fuse screwed into the nose. Some of the material had been loaded into barges, which were moored alongside the pier; the rest of it was still in the cars awaiting transfer. Near the end of the pier, on tracks laid upon solid ground, were eleven cars loaded with 275 tons of Trinitrotoluol (commonly known as T. N. T.), one of the latest and most powerful of the military high explosives. It is used as a filler for high-explosive shells, mines and torpedoes.

Photo Copyright International Film Service

Exploded 3-inch shrapnel with the fuses blown out. Also to right, an exploded cartridge case

Some time after midnight a fire started, either on a loaded barge or one of the loaded munition cars, and before it could be brought under control it reached some cars filled with loaded high-explosive shells, fulminate of mercury, fuses, etc., and detonation took place. There was a terrific explosion. This was at 2:08 A.M. The wrecked cars and the barges burned fiercely and the heat was sufficient to ignite the black powder in the base of the shrapnel shells, bursting the cases and blowing out the fuses. Much of the 3-inch ammunition was "fixed"; that is to say, the shells were attached to their cases, containing the smokeless-powder propelling charge. In this case there was a double explosion—of the powder and the shell. The shells and the powder were packed in wooden cases, and a large number of the latter blown into the bay, were carried far and wide by the tide, and many cases were found floating several miles from the scene of the disaster.

Thirty-five minutes after the first explosion, the interval being filled in with the continuous booming of the bursting shells, a more than usually severe shock proved sufficient to set off the eleven cars of T. N. T. The downward blow of this frightful detonation formed a huge crater 350 feet long, 80 feet wide, and from 10 to 15 feet deep. Where the cars stood is now a salt-water lake! Of the steel

(Concluded on page 161)

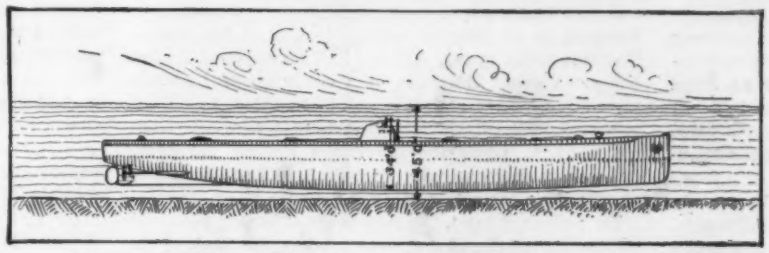
Note the rocket-like streaks, marking the path of exploding shells on barge

Barge of ammunition burning between pier and Statue of Liberty

Sub-Surface Blockade Running

Submarine Blockade Running Difficulties at the Entrance to the Chesapeake

ON August 2d the Navy Department gave out the information that a dispatch had been received from the commander of the destroyer "Sterrett," which was on patrol duty at the Virginia Capes, stating that the tug "Thomas F. Timmins," which convoyed the submarine freighter "Deutschland," had reported that the undersea boat had passed out of the Capes at 8:30 P.M., August 2d. The Associated Press launch, which had followed the "Deutschland" until they lost sight of her (presumably because of her submerging not far from the three-mile limit), failed to detect any signs whatever of that large British Allied patrol fleet of cruisers, motor boats, seaplanes, and what not which the daily press reporter, with his shrewd eye to the public interest in the matter, had informed the public was gathered off the Virginia Capes, ready to pounce upon the lone sub-sea boat as soon as she crossed beyond the friendly line defining the three-mile limit. Of course the failure of a crowd of newspaper reporters to detect any signs of a blockading ship or ships does not by any means prove that they were not on duty. The sea is wide and the coastline is long. It is conceivable that a blockading patrol was strung out across the wide entrances of the Chesapeake, and that it was hull down when the "Deutschland" passed the Capes; but we very much doubt it. If the "Deutschland" was intelligently handled (and Captain Koenig has already proved his ability), the chances of her getting away by night undetected were extremely good; and it is probable that before daybreak of August 3d the "Deutschland," running at the surface, was headed for the north coast of Ireland, with every prospect of reaching it without any mishap other than what might result from wind and weather.



Clearance conditions when submarine is submerged in 45 feet of water

We are told that the "Deutschland" is the forerunner of a whole fleet of cargo-carrying submarines, which will run with regularity between Germany and the United States until the conclusion of the war. If so, and passages are made with frequency, the Allies, no doubt, will make some serious effort to intercept the craft when they sail from American ports, and, if this is done, the problem of getting away will become somewhat serious and decidedly full of interest. For this reason we present some sketches showing the problems which confront a submarine of the size of the "Deutschland," if she passes out through

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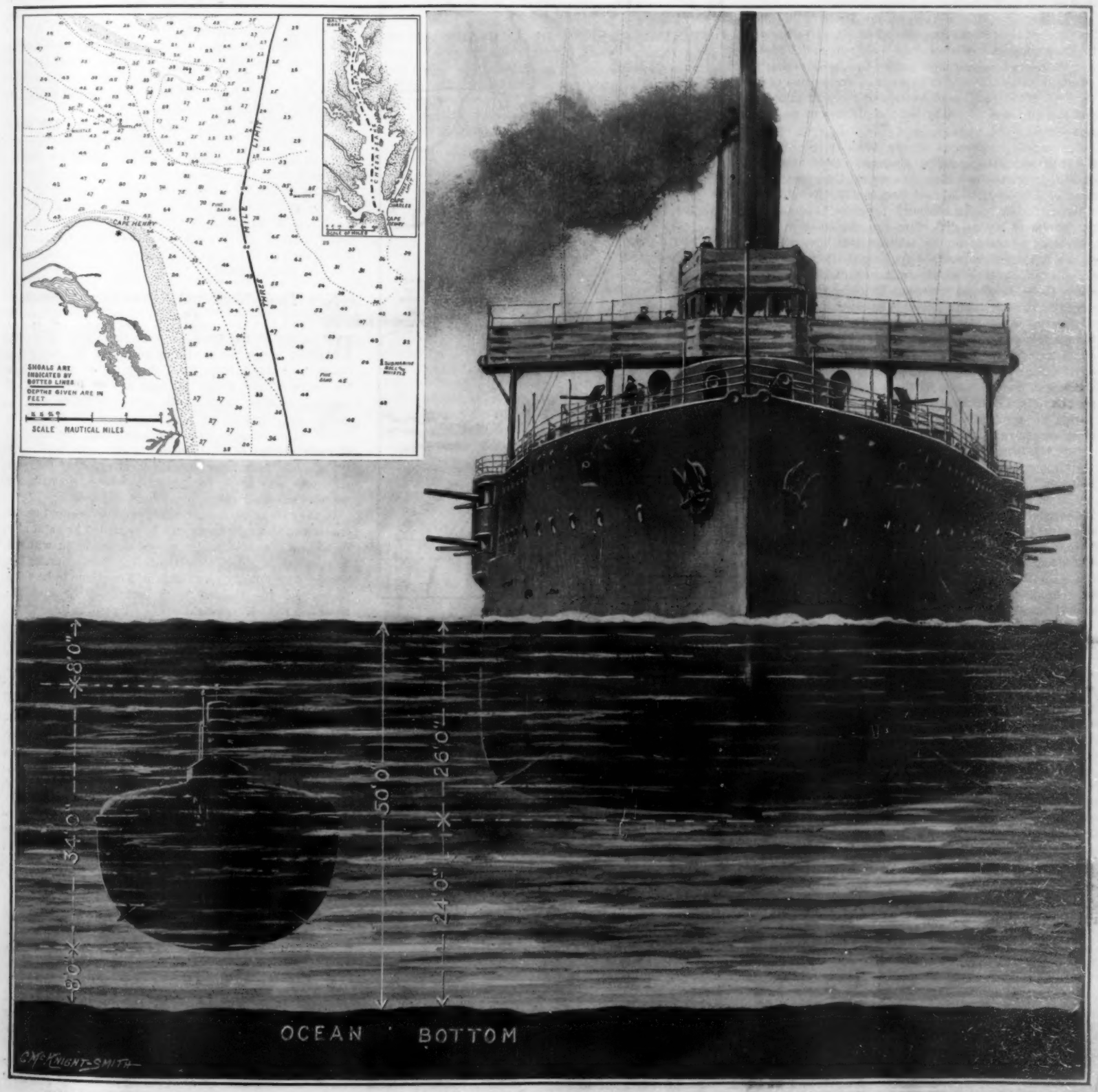


This drawing shows the British cruiser "Berwick" and the "Deutschland" in 50 feet of water. The insert is a chart of Chesapeake entrance, showing the depth at low water. The tide here is about 5 feet, giving 45 feet in the shoal spots of the channel

Strategic Moves of the War, August 4th, 1916

By Our Military Expert

THE Russian front continues to engage public interest to a greater extent than any other theater of war. While the map does not show any tremendous gain of ground, it has changed sufficiently to furnish evidence of a firm foothold west of the line of the Stokhod having been secured by the Russian advance.

There is every probability that Kovel and Lemberg will fall before long; so certain does this seem it is reported that the great stores of munitions at these points are now being removed farther into the interior, that the cities may be defended so as to exact a price in casualties for the winning of them without the sacrifice of the depots of supply.

The greatest advances of the week have been made along the front beginning in the vicinity of Buczacz, extending to the northward. This is the first marked gain reported in this sector since the beginning of the offensive, and it was brought about by the capture of Brody and the accompanying advance of the Russian forces in a southwestward direction. North and northwest of Brody, the Russian line has slipped farther over the Galician frontier in the direction of Sokal, the particular horn of the advance gaining more distance toward the northern approaches to Lemberg.

Still farther to the northward, the Teutonic line has been forced back in the direction of Vladimir-Volhynski, the line surging westward from Lokatchi and Kicelin. A well defined salient now exists in the direction of Vladimir-Volhynski and as there is no strong line of defense between the present position of the attacking line and the city, any day may see an advance to the railway head.

The present closeness of the Russian position to Kovel is due to the abandonment by the Teutonic forces of the deep salient which was marked by the sharp bend of the Stokhod almost due east of Kovel. The Russian forces had made such progress in extending the flanks of their line before the city that a sharp success at either extremity might easily have resulted in a great disaster to the defending troops; they held on up to the limits of safety as it was, and only retired when there developed a strong Russian attack which might have spelt ruin if opposed too long. The present position seems to constitute a gain to both sides; Russia has acquired territory by the straightening out of the salient, and is nearer her local goal by the depth of the angle; on the other hand, Teutonia gains by retirement a line shorter by many miles, requiring proportionately fewer men to occupy it—an opportunity not to be despised when Teutonic losses and lack of reserves are taken into consideration.

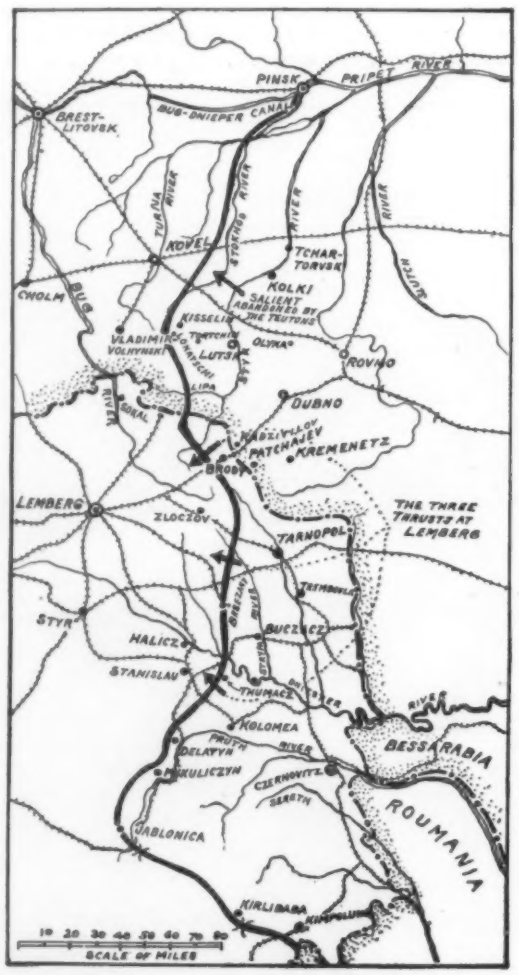
Kovel is directly on the river Turia. This stream marks a strong line of defense and it curves to north and south of the town, half-surrounding it, like the wings of a redan, joining the Pripet farther north. Passage across it will have to be blasted by the Russians if they are to gain its western bank, unless Vladimir-Volhynski is taken before its line is reached. The river can be turned from the south—from the direction of Vladimir-Volhynski, but the operation might be a dangerous one, for an advance to the northward would leave the left flank directly exposed to the strong line of the Bug, admittedly the next general line of defense if the Russians force retirement.

The loss of Kovel and Lemberg—or of either alone—would seriously cripple the kaiser's armies of the east. There is not another junction of as much importance as Kovel anywhere nearer than Brest-Litovsk, about 75 miles to the northwest. From Kovel five railways radiate, two thrusting eastward, avenues of supply and for the rapid massing of force in the direction of the Russians; another winds southward, connecting ultimately with Lemberg, forming a lateral line of communication roughly following the position of the front. If this is cut at Vladimir-Volhynski or nearby, the great wedge which Russia is thrusting in between German and Austrian forces will have garnered its first fruits of importance. On the map, this great wedge is imposing, like the point of a dagger aimed at the heart of the eastern line; if its thrust goes through, the two armies will be definitely severed, for there is not another railway for more than a hundred miles which can even approximately connect the allied Teuton forces.

There is no place in all Galicia, or anywhere nearby, of as much strategic importance as Lemberg. Here are concentrated eight railways, a perfect wheel. Possession of the city and its advantages enables whatever Power holding it to dominate the entire section. Railways to one side serve for the drawing of needed supplies from the interior; the north-and-south lines are for the speedy distribution or concentration of troops; the lines on the other side are the avenues of direct attack.

The Russian forces which have cleared Bukovina have seemed inactive for a number of days; a pause has come in their operations which may be attributable to either of two causes. With the gaining of positions on the Carpathian tops, perhaps time may be taken to bring up a sufficient quantity of supplies, ammunition and such heavy guns as are available, for a descent into Hungary in an effort absolutely to control the passes. Transportation is very difficult and reawakened Russia has given every indication of a newly adopted system whereby offensive action is not to be taken in a half prepared manner. If it is the intention of the high command to undertake operations against Hungary, there is every reason for quietude in the section while preparations are under way for resumption of advance.

On the other hand, the possession of strong positions on the line of the Carpathians renders the flank of an advance through Galicia as secure as may reasonably be hoped for. Trails are few, even for infantry files;



The line on the Eastern front up to August 4th

passes are fewer; and with their tops crowned with guns, a minimum of men can secure the positions, leaving the men thereby released for service to participate in the general advance to the westward.

At the present moment, this seems to be the scheme of the Russian attack in the direction of Lemberg. This city is now threatened from three directions. The southern flank of the wedge being driven in between the Austrians and the Germans has already passed Brody, and the wedge is being extended, widened, directly upon Lemberg from the northeast. East of Lemberg the Russians have made less progress than elsewhere; but it is not necessary that attempt be made to batter in this line when the ground may be gained at a less sanguinary cost by the extension of the north and south wings of the great armies in the effort to envelop the city. Northwest of Kolomea, in the direction of Stanislau, the Russians are battling in the attempt to gain positions to the south of Lemberg, from which a definite stroke may be delivered upon the city. If the northern armies continue to advance from Brody and if the Kolomea forces succeed in pressing forward, the Austrians will be pinched between the two and, to avoid the danger of complete disaster, being cut off in the trap, they will have to abandon the front of what is practically a great salient, just as Teutonia had to abandon the Stokhod salient before Kovel.

There is a limit to human endurance. While it is true that only a given number of men can occupy a given extent of ground, that so many guns only are necessary to its defense, if losses by gunshot and capture become too great to hold the line in force, if there are insufficient reserves to adequately back up the advanced positions, a tenuous line must result and a break become easier to make. In such circumstances, when a break comes it affects the entire extent of the position, for there can be no stemming of the tide. For this reason it is the belief of most observers of the war that if a general collapse occurs in the eastern front, it will be with startling suddenness—as unexpected as was the news in early June that the Russians had advanced and taken Lutsk; yesterday they were there, in the winter-long position—to-day they are at Lutsk!

On the western front there is little change to indicate. Attack and counterattack are the order of the day. Germany has massed great strength in the Somme sector to oppose the Allied advance, which is proceeding with unabated energy, little by little; but the energy is not so much expressed in continuous and hard-headed assaults anywhere and everywhere, as it is by carefully calculated advances after adequate artillery preparation with the sole objective some small point of defense held by the Germans, small but important steps in the working out of the slow process of nibbling—but relentlessly.

Some slight encounters between Serbs and Bulgarians have been reported. These are hardly indications of the beginning of Sarrail's attack but are probably merely attempts to gain advantageous positions against the moment of general advance.

In Turkey, the Grand Duke has advanced his lines beyond Erzingan, in the direction of Sivas, the central point in the line of defense next available to the Turks. The real threat to the Ottoman Empire lies, not so much in a general advance of the line now in Persia and on the border, as in a downward thrust to the southwest of Erzingan, a thrust that would clear the upper reaches of the Euphrates and interpose between that river and the Sivas line, a direct reach toward the Gulf of Alexandretta.

New Trade-Mark and Patent Law in South Africa

BY an act of the Parliament of the Union of South Africa, which received the assent of the Governor General on April 15th, 1916, the laws of the various Provinces of the Union relating to the protection of patents, designs, trade-marks and copyrights are repealed and replaced by a uniform law for the whole Union. Provision is made for continuing the validity of registrations effected under the old provincial acts. Within one year after the commencement of this act patentees may apply for patents under the Union act without affecting rights previously acquired.

In the case of trade-marks, registration secured under one of the provincial acts will be regarded as valid also under the new law, and a second registration will not be required in order to receive full protection under the new law. Similarly copyrights will continue to be valid throughout the Union. With certain slight modifications the British copyright act is adopted in its entirety as the law of the Union of South Africa.

Fees are prescribed for patent applications, and the Governor General is authorized to prepare a schedule of fees for other purposes and to make the necessary regulations for carrying into effect of the act. The different sections of the act relating to patents, designs, trade-marks, and copyrights are regarded as independent, and the Governor General is authorized to fix by proclamation the date upon which each is to come into effect.

The privileges of protection for patents and designs are not to be extended to the citizens of countries outside of the Union until it has been determined that such countries grant similar privileges to the citizens of the Union of South Africa, and a proclamation to that effect has been issued.

Expansion of Concrete in Cold Weather

MEASUREMENTS have been taken by the United States Bureau of Standards of the change of dimensions of concrete on a test road on the Bureau grounds and also on the Coleman du Pont Road at Millsboro, Del. The results thus far confirm those previously obtained by the Bureau on the New Village, N. J., and Nazareth, Pa., roads—that during the winter and spring there is an expansion of the concrete caused by increase of moisture content, and in the summer a marked contraction caused by loss of moisture. This is contrary to the generally accepted opinion that concrete expands most in midsummer and least in winter.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Automobiles and Preparedness

To the Editor of the SCIENTIFIC AMERICAN:

I wish to make a suggestion for a system of securing a large percentage of the automobiles in any section of the country, with drivers, repairmen, supplies, parts and repair facilities, for emergency war use in a minimum amount of time and with a maximum amount of thoroughness.

Automobile dealers are spread over the entire country, even to the small towns in the counties. Automobile dealers' associations cover this territory more fully than any other organizations. The members of these associations, by means of their branch houses, agents and sub-agents, constitute the bulk of the automobile dealers. The few dealers not directly included in associations are known to and in touch with the association members, so that no place fails to come under their attention.

Automobile dealers, from the nature of their business, collectively know all the cars, the drivers, repairmen, supply houses, and repair facilities in their territory, which means the entire country. No other class of men, bureau or source can know this as well as they do. Regarding cars, they know the types, conditions and uses for which they are best adapted. As to drivers, they know those fit for high-pressure work, the ordinary, and the unfit for possible military car use. They are in close touch with all auto supply houses, gasoline tank stations, oil dealers, tire depots, etc. As to the repairmen and facilities, they know the men and their ability and the locations and value of the various garages and repairshops, together with their particular stock of parts for the various makes of cars.

Thus the essentials are all at hand for a quick mobilization, concentration and transportation of troops, supplies, etc., by automobiles to any desired location. The method of bringing this about is through the dealers themselves, under military control and with military authority to commandeer both men and cars, and the other essentials. Given the emergency and necessary start by orders backed by military authority, the procedure would be to pass the instructions along by steps somewhat as follows:

1. To the dealers' associations in the section to be covered.

2. By the associations' officials directly to the supply houses, gasoline, oil and tire dealers, etc.

3. By the associations' officials to their individual members and all non-members of the same general class.

4. By these dealers to their own lists of (a) car owners (cars which they represent): (b) car customers (cars which they do not represent): (c) sub-agents (to pass along to their a's and b's): (d) selling representatives, garage and repair shop men in the smaller places, to pass along to their (a)s and (b)s.

The operation of passing along the information and orders would be simple. The dealers in taking the fourth step would use emergency telephone and telegraph service, and possibly messengers, as circumstances dictated.

Preparedness for this course would be to have the authorities and the associations under agreement with a certain amount of instruction given. This would take care of steps 1, 2 and 3. No preparedness is necessary for step 4, as this would be an order to an individual, to be obeyed.

That no exacting promises are required from the car owner, driver or repairman, or the need of his being specially instructed or drilled, is a decided advantage. He does not have to be a soldier. He is called for the purpose of driving or repairing cars, as he is deemed fit. If a car owner of good driving ability, he would drive his own car, otherwise he would simply give up his car for some driver, not a car owner, to handle; all under military control and discipline; all untrained as soldiers, but experienced in the work to which they would be assigned. The vast number of car owners, drivers, etc., do not want to drill as soldiers, but they are ready to give their best along their lines, and, properly handled, they would give better automobile results than a body of trained soldiers would do with the same cars. Many a man could give good, efficient service along these lines who would be rejected for physical reasons from ordinary military duty.

In a given locality the native automobile man knows his roads better than the maps show them. The dealers either know this themselves or know the men that know them. The "Preparedness" details for this movement could be easily and quickly given by the military experts to the dealers' associations, and this passed on to the dealers themselves. With an understanding of what the experts wanted and definite orders given them, the dealers would be able to order the number of the types of cars required, with the necessary drivers and repairmen, and have them assembled within a very short space of time.

Auxiliary to step No. 2 would be the taking over of the proper repair parts from the various shop stocks and the utilization of the most convenient of these shops and garages. In connection with step No. 3 would be the equipment of a service or repair car by each member, with special tools, men and a stock of parts for his particular agency.

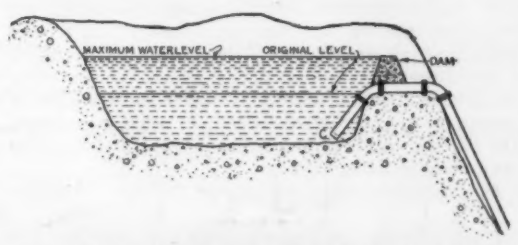
Automobile factories should not be affected by this plan, as their value would be far greater if left alone to rush car production. Men in the factories should also be left alone for the same reason. Neither does the plan interfere with the several schemes proposed, such as that of the "Automobile Reserve Corps." These usually have for their object the use of cars (and drivers) in small company units by military organizations and entail instruction and drilling. This good work should go on, and would provide automobile forces for selected uses, whereas the dealers' plan gives a multitude of cars and trucks handled by good automobile men, but requiring much military supervision.

WORCESTER, MASS.

A Suggestion for Water Power Engineers

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the article on hydro-electric plant of the Eastern Oregon Light and Power Company, in your issue of July 1st, may I state a much simpler way which has occurred to me of making available at all times the full capacity of the storage lake? If the outlet pipe were carried down as near as possible to the bottom of the reservoir, practically all the water would flow out without special machinery of any kind: for after the ordinary pressure flow had reduced the surface from



Siphon device for using water from below intake level

the maximum water level to the original level, the outlet would continue to act as a siphon, and empty the reservoir right down to the level of the intake (c). It would not even be necessary to have mechanical means of setting up this siphon action, since it would follow at once from the previous flow set up in the pipe.

This is merely a suggestion, given for what it may be worth. It would probably save some trouble from ice in the winter, as well.

S. T. WELLMAN.

Cleveland, O.

The Astronomical Page

To the Editor of the SCIENTIFIC AMERICAN:

I think it is about four years since I first began to notice the maps of the sky and the interesting articles by Prof. Russell in the AMERICAN. At first I did not take much interest in them as I had never studied astronomy and knew nothing about it. It soon occurred to me that I might be able to learn the names and location of some of the brighter stars, and I began to take an interest in the maps—so that I am now familiar with the more important stars—and can locate them readily, and the maps and articles are the most interesting feature of the paper.

J. A. HARKNESS.

St. Louis, Mo.

A New Appendicitis Theory

To the Editor of the SCIENTIFIC AMERICAN:

The tinned wire broiler was first introduced about forty years ago. Just about that time appendicitis became popular. Perhaps there is no connection between the two, but the average broiler has about 55 square inches of tin coating, all of which eventually sticks to the meat and is swallowed.

Sometimes the tin coating is very heavy and peels off in large sections. The fact that often two or more cases of appendicitis occur simultaneously in the same family points to a common cause.

The tinned broiler is a menace and should be barred.

S. A. BROWN.

Buffalo, N. Y.

Why Do We Laugh?

To the Editor of the SCIENTIFIC AMERICAN:

May I ask the opinion of your readers of the following "Theory of Laughter" through the columns of the SCIENTIFIC AMERICAN?

The sensation aroused by a tickle is reminiscent of the nosing or sniffing of a quiet object by an animal before taking hold with the teeth. The laugh and convulsive movement are instinctive efforts to scare away the intruding animal without arousing his combativeness by a snarl or growl.

On the other hand, the intellectual laugh is fundamentally a shout of triumph caused by the discovery of a pleasant idea.

F. A. LIPPINCOTT.

Sharon, Pa.

A Correction

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of the 8th ult., page 35, appears an article "How the Shrimp Industry Saved Fernandina," by Mr. Charles M. Maigne, in which appears the following sentence:

"So far as is known it (Fernandina, Fla.) is the only place in the United States where shrimp may be caught all the year around in paying quantities."

For the information of all interested, I wish to state that shrimp in practically unlimited quantities are caught in San Francisco all the year round, and have been to my knowledge for 45 years past. The entire area of the Bay, approximately 400 square miles, produces shrimp. Shrimp meat, sun dried and pressed, is exported in large quantities from this city by the Chinese to China. In scores of San Francisco restaurants shrimp are served free as an appetizer while your order is being prepared.

JOHN S. INGLIS.

San Francisco.

Determining Gas Engine Ratings with New Form of Slide Rule

BY the movement of the sliding member of a new form of computing rule, it is possible for even the veriest tyro to determine at a glance the brake horsepower which any gas or gasoline engine will develop, provided the bore, stroke, and revolutions per minute are known.

The new slide rule, invented by D. O. Barret, an American mechanical engineer, is made of aluminum. It consists of two members: first, the stationary piece which carries the graduations for "bore" at the top and the graduations for "brake horse-power" at the bottom; second, the sliding member which moves between the two graduated scales just mentioned and is itself marked with a scale for the "stroke" and another for the "r.p.m."

To operate the new slide rule, the bore and stroke of the engine under consideration are located on the two upper scales and alined, the brake horse-power which the engine should develop appearing underneath the graduation representing the number of revolutions per minute at which the engine is to be operated.

Distribution of Energy in the Visible Spectrum of an Acetylene Flame

DATA on the distribution of energy in the visible spectrum of a standard source of light are frequently needed in connection with investigations in physiology, in psychology, and in physics; especially in photo-electric work, in photography and in the photometry of faint light sources. The acetylene flame appears to be a promising source of light having a high intensity and a white color.

Numerous requests having come to the Bureau of Standards for data on this type, an investigation was made to supply the information desired and the results have been published in SCIENTIFIC PAPER No. 279, just issued. The paper gives data on the distribution of energy in the visible spectrum of a cylindrical acetylene flame operated under specific conditions.

The Property of Plastic Flow

THERE is a property of certain forms of matter, such as clay used in making pottery, which has long been regarded as of great importance, but which has never been understood. This property, known as plasticity or the capacity of a material for being molded into a desired shape and then retaining it, has been made a subject of study by the Bureau of Standards.

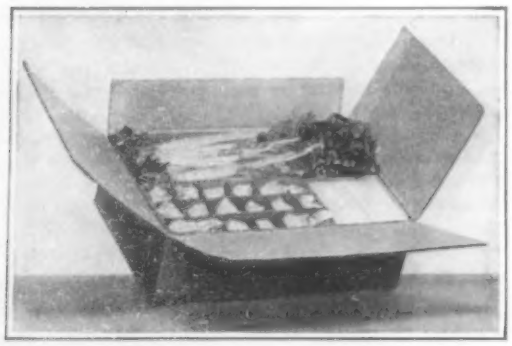
Forcing mixtures of clay and water through tubes of small diameter, the rates of flow at different pressures were measured. The experiments showed that, in a plastic substance, a considerable force is required to start the flow or to overcome the friction between the particles of solid. This friction in plastic flow enables one easily to distinguish between a plastic substance and a true fluid, even though the fluid may be very viscous, like pitch. It was found that the plasticity of a material depends principally upon the fineness of the solid particles. It can be measured by the force required to overcome the friction, and by the rate of flow after the friction is overcome, this latter quantity being known as the "mobility."

Agricultural Preparedness

What the Government Is Doing Toward Better Production and Better Distribution

By Charles J. Brand, Chief, Office of Markets and Rural Organization, U. S. Department of Agriculture

NOWHERE is preparedness more vital to a nation than in agriculture. Here it is a fundamental necessity, with the great advantage that preparedness for or against war is equally valuable for peace. This is true of both production and distribution, but especially of the latter; there never has been a time when the need of efficiency in distribution has loomed with greater importance than at present. And while we shall discuss this need solely in connection with the distribution of agricultural products, it is felt only in less degree in the manufacturing field.



Combination package for postal delivery of eggs, butter and celery or chickens

The dire necessities of the European war have forced upon European countries an extraordinary degree of efficiency brought about largely through legally authorized and enforced central governmental control of products and the machinery of distribution. For instance, it is reported from England that the first pinch of war was felt in the case of sugar. That country is said to import nearly 4,000,000,000 pounds of sugar annually, and was found at the outbreak of the war to be short. Two thirds of the normal supply came from Germany and Austria. The Government took control of the sugar supply and the sugar market, purchased over $85,000,000 worth of sugar, fixed both wholesale and retail prices, laid a war tax of 2.24 cents per pound, which, with other taxes, made the duty 3.36 cents per pound and still raised the price to consumers by only 1 cent per pound. The consumer was thus protected and the treasury benefited to the extent of nearly $35,000,000. The elimination of waste by economies of this character no doubt will result in the continuance after the war of many of the methods that have been worked out during its progress. The achievements of the Central Empires in these directions are not so well known as those of the Allied countries, though on account of their greater necessities, they probably have been even greater. The fundamental economics involved in such Governmental activities will require future consideration, as well as the results secured.

The efficiency needs of agriculture relate primarily to production and distribution and the financing of both. On the production side, Federal and State Governments have spent great sums of money and have accomplished much. New and improved races of animals and varieties of crop plants have been originated by breeding and selection; ways and means have been devised for the treatment, destruction or control of plant diseases and crop-destroying insects; new fertilizers have been put into use; better rotations and methods of tillage have been devised; and many new and valuable plants have been introduced from foreign lands.

With regard to farm financing, much progress has been made by the private agencies engaged in this field, but so much remains to be done that nothing short of Governmental supervision and assistance seems adequate to the need. Congress has given much study to the question, and as this is written a rural credits bill (S. 2989) is on the eve of passing the two Houses, the conference committee of both having unanimously brought in a favorable report.

Concerning the marketing and distribution of farm products, which embraces all of the problems involved in the transfer of the product from the producer to the consumer or user, relatively little has been done. The absolute need of the public for certain things and the products derived from them, such as wheat, cotton and live stock, has made these so important to life and industry that there has been evolved a rather well-defined marketing machinery to handle their distribution, leaving, however, many acute and difficult problems for solution.

In the case of fruits, vegetables, dairy, poultry and many other farm products, such marketing facilities as we have "just growed' like Topsy, and are correspondingly crude and in need of improvement. In passing it may be said that nothing is harder to improve than something that "just growed." Perhaps it is because it is such a queer combination of economy and waste, but more likely because in the process of growing so many interrelationships and vested rights come into existence that change means cost or loss to someone or some class or classes who are influential in preventing change. There is no desire to detract from the high degree of efficiency that has been attained under existing conditions.

When we realize that apples, potatoes, peaches, onions and other things often bring such low prices on the farm in the production areas that the farmer must sell them at a loss if he harvests them at all, while the wage-earning consumer is forced to deny himself because prices are still so high that he cannot afford to buy them, we have some phases of the problem in a nutshell.

The links in the chain that need attention are: First, the farmer; second, the wholesaling middleman, be he jobber, broker, car-lot distributor or what not; third, the common carriers; fourth, the retailer, and fifth, the consuming or using buyer.

The farmer needs to organize for the standardization of his products; for better packing in uniform packages; for the provision of better storage facilities; for the application of better business methods; for a proper adjustment of production to requirements of consumption; for the collection, dissemination and effective use of market information (especially concerning perishable crops) as to crop areas, conditions, prospective supply, prices, conditions affecting demand, etc.; for opening new markets, both domestic and foreign; and also to provide suitable facilities for preserving and utilizing surpluses which are sure to occur in the best organized and adjusted agriculture.

Our country is so large, its problems so manifold and difficult and its products so varied that some government assistance seems essential for the achievement of a rational and efficient distribution. Such assistance should also result in making available, when national danger may demand, those supplies of raw farm products essential to life and manufacturing industries. The

How a well packed and a poorly packed basket of lettuce arrived at market

fact that tens of thousands of carloads of perishable products must move distances exceeding 3,000 miles affords an index to the difficulty of working out a satisfactory solution.

During the five years just passed, there has grown up a powerful demand from the consumer as well as the producer for improvements in marketing methods. The Federal Government was the first public agency to give recognition to it. Congress authorized the Department of Agriculture to investigate the cost of food supplies at the farm and to the consumer during the fiscal year ending June 30th, 1911. In 1912, Congress, in making appropriations for the fiscal year ending June 30th, 1913, authorized the department to make an investigation of systems, coöperative and otherwise, of marketing farm products in practice in the various sections of the United States and of the demand for such products in the various trade centers, without, however, making a specific appropriation for the purpose. A valuable report was made under this authority.

In the agricultural bill for the following year, 1914, Congress appropriated $50,000 to enable the Secretary of Agriculture to acquire and diffuse among the people of the United States useful information on subjects connected with the marketing and distributing of farm products. Under this authority, on May 15th, 1913, the Office of Markets was established in the Department of Agriculture. In the appropriation act for the fiscal year 1915, Congress provided the sum of $200,000 for marketing work and $40,000 for making studies of coöperation among farmers in matters of rural credit and other forms of coöperation in rural communities and for diffusing among the people of the United States the information growing out of these studies in order to provide a basis for broader utilization of results secured by research, experimental and demonstrational work of the Department of Agriculture, agricultural colleges and experiment stations.

In appropriating for the fiscal year 1916, Congress provided $484,000 for marketing and rural organization work, including the administration of the United States Cotton Futures Act, while the bill now pending provides about $800,000 for 1917.

During the first year, in order to shape up sound policies and practical working plans, the work was largely preliminary and investigational. During the following year certain investigations in the line of coöperation and of marketing and the dissemination of market information had proceeded sufficiently to make possible the

Left, ungraded sweet potatoes as usually shipped; right, graded in accordance with Department standards

Room for cotton inspection and standardization. Note the special light diffusing skylights

rendition of specific service to the farming community.

During the fiscal year just ending, June 30th, 1916, activities of a wide range have been in progress. A brief summary is all that could be attempted in this connection. A detailed survey of the extent and character of coöperative enterprises in the United States has been practically completed, in the course of which nearly 11,000 enterprises of a coöperative, semi-coöperative or mutual character have been located. Nearly 5,500 of these organizations have made detailed reports to the department covering their activities, including capitalization, product handled, methods of organization, etc. It is estimated that the total business of all amounts to $1,400,000,000 a year. The strengthening of these organizations and the giving of assistance to the formation of new ones has been a constant activity.

Help has been given to the apple growers of the four Northwestern States, the strawberry producers of Louisiana, the grain growers of the Middle West, the fruit and vegetable growers of the Carolinas, and the potato growers of Maine.

The laws of the various States, under which coöperative enterprises must be conducted, have been carefully studied and suggestions have been made to several of the States desiring to enact new legislation. The methods of financing coöperative marketing associations have been studied and publications issued on the subject. Coöperative live stock shipping associations, community egg circles and other forms of coöperation are receiving attention, as well as the business methods of such organizations. A uniform system of accounts for country grain elevators has been devised and is already in use by over 500 of these institutions. Similar work has been done for coöperative fruit, produce and live stock shipping associations and is in progress for rural creameries. A study is also being made of the reasons for success or failure of coöperative retail stores.

A telegraphic market news service for perishable products has been inaugurated and the department is now issuing daily reports on potatoes, cantaloupes, tomatoes, onions, lettuce, peaches, watermelons, strawberries and cabbages. Other crops will be included as their seasons of production comes on. Permanent branch offices have been established in ten of the great metropolitan markets from which the office receives daily reports as to quantity and condition of goods received, prices, demand, and so forth. In the sections producing great quantities of perishable commodities, temporary field offices are established. These offices report the daily movement of particular commodities with the various destinations of the cars, f. o. b. prices, diversions and other information obtainable at the production end of the industry. Both classes of information are exchanged between the markets and the producing centers. This is the first time such a service has been available to the people of the United States. As an indication of the type of information, we may take the movement of the cantaloupe crop from Brawley, Calif., on June 12th. On that day 203 carloads of cantaloupes were shipped to 66 markets. The average consumption requirements of all cities for which records were obtainable have been charted and a general effort is made to distribute to the cities in proportion to the rate at which they normally consume. On this particular day, twenty-two cars went to New York, twenty to Chicago, twelve to Pittsburgh, ten to Boston, ten to Los Angeles, nine to Philadelphia, seven to Cleveland, six to Kansas City, six to St. Louis, five to Seattle, four to Detroit, two each to such markets as Memphis, Oakland, Omaha, Providence, Topeka, etc., and one each to many other cities, including Atlanta, Baltimore, Birmingham, Des Moines, Little Rock, Portland, St. Paul and Winnipeg. As a result of this work, glutting, with its attendant disastrous results to producers, is to a certain extent avoided, the consumers of the United States more generally obtain cantaloupes at reasonable prices, the expensive diversion business of the railroads is reduced; and all this effects a considerable economy and in general a more uniform and scientific distribution, to the general advantage of producer and consumer alike.

Coöperative grain elevator in Iowa, owned and operated by producers

Prime Angus steers in Chicago stockyards

Other kinds of work are undertaken, including a study of various market methods in vogue in the United States, outlets for shipment of fruit and vegetables, methods of wholesale distribution and the origin and commercial movement of specific crops. Onion growers and distributors in the great Texas onion territory in the vicinity of Laredo have estimated that the telegraphic information secured and released by the department resulted in saving for them from one half to one million dollars. The money value of work of this character cannot be definitely determined, nor is it necessary that it should be.

The grading, packing and handling of fruits and vegetables is being studied and information has been published with respect to several crops. Studies of packages and containers and methods of bringing about uniformity in capacity and dimensions are also being carried on. The necessity for this work is sufficiently indicated by stating that containers of over 200 different types and sizes are now in use.

Problems of transportation and storage, including the losses of foodstuffs in transit, the improvement of refrigeration conditions, the issuance of reports on the quantity of apples and other products in storage are also being considered.

Cities are being assisted in studying their problems connected with the establishment of municipal marketing enterprises, both wholesale and retail. Terminal trackage facilities for produce and distribution therefrom are also receiving attention, as are the questions involved in marketing by parcel post and express.

Warehousing of products and the marketing of specific products are also receiving extended attention, as are the handling and marketing of cotton, cotton seed and its products, and the marketing of live stock, meats and animal by-products. This work includes a study of the great central live stock markets, municipal abattoirs, coöperative meat-packing companies, live-stock and meat market reports. The marketing of grain, both at primary or producing markets and in the great terminal markets, has been looked into. Studies of the marketing of dairy products have been inaugurated and those of methods and costs of collecting milk and cream and of distributing butter and cheese have progressed to a considerable extent.

Investigations of the rural credit situation in the United States have been conducted for two years, as regards both farm mortgage loans and short-time loans. The great variation in the rates of interest in the various parts of the country have been determined and groups of borrowers desiring to form coöperative associations have been assisted. There are nearly 1,200 mutual fire insurance companies in the United States and many organizations for insurance against hail, windstorm, and for live stock. Their methods have been studied and assistance has been given them in perfecting their plans and operations.

Official cotton standards of the United States have been established and have been adopted by nearly 30 of the spot markets, including the New York and New Orleans future exchanges, upon which their use is compulsory. In something over a year, over eight hundred sets of standards, including nine grades, each grade displayed by twelve types have been sold to the cotton trade of the United States and to foreign countries. The true grade, staple or other quality of nearly 75,000 bales of cotton has been determined in disputes presented to the department under the provisions of the United States Cotton Futures Act.

This brief summary will convey an idea of at least a part of the work toward agricultural preparedness that has been undertaken by the Department of Agriculture.

The Current Supplement

AN article that will be of interest to physicists and chemists, as well as to astronomers is *The Problem of the Chemical Origin of Solar Radiation*, which appears in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2119, for August 12th, 1916. *A New Use for Aeroplanes* tells of attempts that were made to succor the British force at Kut, in Mesopotamia by means of aeroplanes, and is illustrated by two excellent photographs. *The Carpathians* gives an excellent topographical description of the region where the Russians conducted an important campaign last year, and which may be the scene of further critical operations in the near future. The article is illustrated by photographs and a geological outline map of considerable value. *Living Artillery* is an interesting description of various means of offense and defense which nature has furnished to animals, plants and insects, and is accompanied by a number of excellent illustrations. *Hay Fever* is a timely article describing the cause, treatment and prevention of this annoying disease of the summer season. *Paper for Artistic Printing* tells about material of individual character suitable for reproducing fine engravings and etchings. It is written by an amateur investigator, and is illustrated by cuts showing the author's picturesque paper mill, and specimens of paper. *A New Roentgen Tube* describes and illustrates a new tube for use in surgery that is said to be a decided improvement over those now used. *Ore Flotation* discusses and reviews a process of great importance in the separation of ores that has as yet been but partially developed. Other valuable articles include *The Manufacture of Porcelain* and *Malt Extract in the Laundry*.

Gradual Ascendency of the United States as an Asbestos Producer

ON account of the restrictions placed upon shipments of asbestos from Canada, which is the world's chief source of supply, attention has been given by the United States Geological Survey to the possibility of utilizing the asbestos deposits in this country to an increased extent. Facts which the Survey has furnished for the benefit of prospective purchasers of the domestic product are as follows:

In 1915 there was a great increase in the production of high-grade asbestos in Arizona. The lower-grade asbestos produced in this country comes mainly from Georgia. Both these States are capable of increasing their output. Some years ago Vermont had a productive mine, largely in the chrysotile variety of asbestos, in the same belt of rocks that contains the rich deposits of asbestos in Canada. For the last few years the mine has not been in operation, but as a result of the Canadian embargo it may again become a valuable source of supply. Virginia in 1905 and 1906 produced a small quantity of low-grade asbestos that is still used in the manufacture of a local asbestos product. The fiber is of the amphibole variety and slip-fiber type. It was quarried near Body Camp and hauled 12 miles to a mill at Bedford City.

There has been much interest in the asbestos reported from Casper Mountain and other regions in Wyoming. Some mills have been erected, but although there has been as yet no commercial production the quality of the fiber, in part chrysotile, is locally encouraging. Idaho has in the Kamiah region large deposits of material like that of Georgia. California has produced asbestos, generally of low grade, at a number of points.

On the whole, the encouraging outlook in Arizona, which includes also the Grand Canyon region, with the possible resumption of production in Vermont and an increased production in Georgia, may be expected to make up at least part of the loss by embargo in Canada.

Uncovering a Prehistoric Dwelling in Southeastern Colorado

MR. JESSE WALTER FEWKES, of Smithsonian Institution, has been conducting some highly interesting archaeological work in Mesa Verde National Park in recent months. He has uncovered what is known as Fewkes Mound in the Government's archaeological park in southeastern Colorado. This mound has been formed by earth which has drifted over the ruins of one of the largest community houses ever discovered in the southwest. The mound is on top of the mesa, directly across the canyon from Cliff Palace, the largest cliff ruin ever discovered. Only Cliff Palace is built in a mighty cavern in the wall of the canyon, while the building on top of the mesa is in the open.

Trees growing out of the sand that covered the D house at the Mesa Verde National Park

The outside wall of the D house, as excavated by Dr. Fewkes

It will require several seasons of work to determine the exact extent of the house covered by the debris of Fewkes Mound, but enough has been found to show that the ruin is one of the largest and most interesting ever brought to light by the spade of the archaeologist in this country. The house was two or three stories high. It was in the shape of a huge letter D, and the walls were made of smooth, polished stone, neatly joined with mortar. Just why the house was built in the form of a D is not known. It is the most peculiar archaeological design ever uncovered, with the possible exception of the circular house of the Rito de los Frijoles, in New Mexico.

The D house evidently is of great age, for large trees have grown in the sand which covered the ruins. It is not known whether the natives occupied this form of dwelling on top of the mesa and then were compelled to take to the better fortified houses in the canyon walls, but such a thing is regarded as entirely possible. No weapons have been found in the ruins of the D house, while many weapons have been found in the canyon homes of the cliff dwellers of this region. The top of the Mesa Verde contains many mounds which evidently cover ruins similar in character to the D house. Also there are ruins of ancient irrigation systems. Similar ruins exist in great numbers in the vicinity of Aztec, New Mexico, probably a hundred miles southeast of the Mesa Verde. But archaeologists assert that the Mesa Verde National Park itself is the greatest archaeological field in this country. There is work here for scientists for many generations. Dr. Fewkes excavated and restored two of the largest cliff ruins, and is thoroughly familiar with the Mesa Verde region. It is the aim to restore the various "types" of ruins, so visitors to this national park can study the various phases of life in this region which was once teeming with activity. The Mesa Verde National Park can be reached by automobile from Mancos, Colorado, after a railroad journey of about a day from Denver. It is a wildly picturesque country, in addition to its archaeological charm, and is rapidly growing in favor with national park tourists.

Moving a Forty-Foot Tree Forty-Nine Miles by Motor Truck

IN the difficult operation of transplanting an oak tree 40 feet high, a five-ton truck was used to advantage, handling the load of 10,470 pounds with ease. The fine oak was transported a distance of 49 miles over exceedingly rough roads and successfully re-planted, a feat which would hardly have been possible without the motor truck.

The operation of raising the tree was very delicate, as it was necessary to use extreme care in excavating around the roots. A heavy oak platform, circular in shape and about 6 feet in diameter, was slipped under the mass of earth clinging to the roots, and heavy sacking and ropes held the tendrils and soil together. The trunk was carefully wrapped to a height of 10 feet and then the operation of working the tree to the truck body began. A crew of 30 men, with rollers, block and tackle and derrick brought the oak from its resting place to the bed of the car, and the tree rolled along in an upright position until it was centered upon the truck. Then it was carefully lowered so that the trunk of the tree projected over the rear of the car. The tree and earth weighed 8,470 pounds, while the rigging, etc., weighed 2,000 pounds more; but the sturdy motor truck pulled the load over steep grades and rough roads to its destination, where the equally delicate process of unloading and resetting was accomplished.

While this was a striking feat it was not the record in big tree removal, as a giant palm in Los Angeles was removed from the center of the town to one of the city parks about 5 miles distant. It was about 60 feet high and required a steam derrick to lift it upon a flat car. The palm was replanted with success and is now flourishing in its new home.

A five-ton motor truck transporting a 40-foot tree over a distance of 49 miles

The Resistance of Greenheart to Wood-Destroying Fungi

IT has long been known that the heartwood of the important South American timber tree called greenheart (*Nectandra radiæi*) is proof against the attack of marine borers which invariably destroy piles and wharves constructed of oak, fir, gums, and other woods noted for their durability under practically all conditions. The merits of greenheart as a material suitable for marine construction have been discussed in a number of technical journals. Its durability and other physical and mechanical properties have been compared with those of other woods often used for under-sea work, and the data show conclusively that this South American timber is by far the most serviceable kind known to engineers. Special consideration must be given to this wood and an optimistic, though conservative view of the ascendency of greenheart for this type of work is becoming quite noticeable among the foremost maritime engineers. The fact is that no other wood is used so extensively at the present time, nor likely to be used more in the future in the construction of lock and dock gates and wharves than true greenheart.

While engineers know from long experience with this wood that it is more resistant to sea worms than other woods employed for marine construction, there has until recently been no reliable published information dealing with the power of greenheart to resist wood-destroying fungi. That incalculable damage is done by fungi to other structural timbers is well known. The results of interesting experiments conducted by Dr. C. J. Humphrey of the U. S. Bureau of Plant Industry, and published in the columns of Mycologia, Vol. VII, No. 4, July, 1915, show that greenheart is practically immune to wood-destroying fungi. Dr. Humphrey records in his paper the findings of a series of experiments both on the heartwood and on the sapwood with a number of different fungi. He shows that the heartwood of greenheart is highly resistant, and is in all cases practically immune to all the fungi used in the tests. Very little effect on the test blocks was noted in a visual examination, in spite of the fact the fungi used developed luxuriantly in the culture tubes. The tests show that the sapwood is more susceptible to decay than the heartwood. Dr. Humphrey states that this meets our natural expectations, as this is the rule with timbers in which the heartwood and the sapwood are differentiated. With further reference to sapwood of greenheart the author writes as follows: The point to be kept in mind is that the sapwood, being so much less resistant to decay than the heartwood, should be carefully considered in timber specifications which call for the best quality of durable material. Not alone is the sapwood moderately susceptible to the attacks of fungi, but it is also reported to be more readily attacked by marine borers, and hence less valuable for wharf construction.

Loading the tree onto the motor truck by means of a block and tackle arrangement

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

An Electrically-Heated Vacuum Furnace for Research Work on Vacuum Irons

IN conducting his researches on vacuum irons Prof. T. D. Yensen has constructed an interesting form of vacuum furnace. It is modeled after that developed by W. C. Arsem, who presented a paper describing this type of furnace before the American Electrochemical Society in 1906.

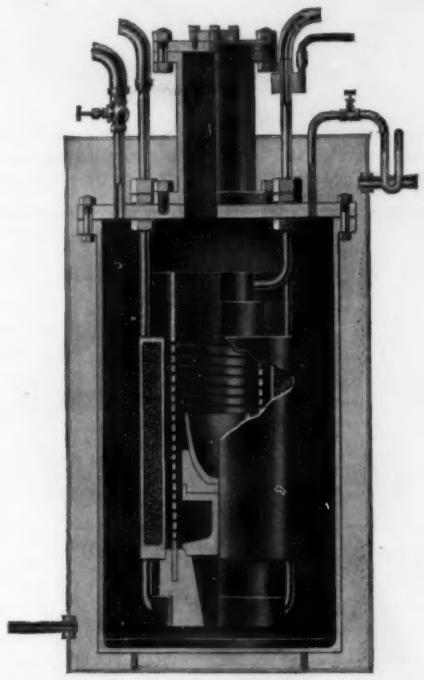
In the accompanying illustration appears a cross-sectional view of Dr. Yensen's furnace. For the vacuum tube he has made use of a section of 12-inch wrought-iron pipe, closing it at the bottom with a ¼-inch steel plate welded in place. At the top a steel ring is shrunk around the pipe and the joint made air-tight by means of a groove filled with molten lead. The cover consists of a ¾-inch steel plate, while the dome is built up of a 4-inch wrought-iron pipe provided with a flange at each end. To permit the inspection of the charge during operation, a mica window is placed in the top of the dome. The joints of the furnace are rendered absolutely air-tight by means of rubber gaskets, and the entire device submerged in a tank of water.

The heating element is of exceptional interest. It is machined out of solid 4¾-inch carbon rod by first cutting a helical groove of the desired pitch and depth and then boring out the center or core of the rod by means of a pipe provided with cutting teeth at one end. Obviously, the work has to be done with great care in order to maintain a uniform cross-section throughout the coil. Surrounding this helix is a radiation screen made from an 8-inch carbon electrode and filled with crushed graphite. The helix and screen rest on a carbon bottom piece, which in turn is supported by a water-cooled copper tubing. The latter is connected to the base by means of a cast-iron clamp, and it serves the dual function of supporting the carbon coil and supplying current to it. It is clamped in place by two air-tight insulated bushings in the cover. The upper end of the helix is supported by another water-cooled copper tubing, to which it is connected by a cast-iron clamp. The pressure within the furnace is gaged by a mercury manometer.

At the beginning of his experiments Prof, Yensen submerged the furnace in ordinary water, but trouble due to electrolysis setting in about the bushings was encountered. As a result the furnace has since been placed in a tank filled with distilled water, which is kept cool by circulating water in the outside tank. As a supplementary cooling provision, cooling coils are placed on the top of the cover. With this arrangement it is said that the temperature is held down to 60 deg. C., which point is seldom exceeded.

In most of the experiments the furnace has been exhausted down to a pressure of 2 cm. to 3 cm. by means of a water aspirator. The pressure has been reduced still further, to 0.5 cm. or below, by the application of a Geryck pump.

With an input of 15 kilowatts it has been possible to raise the temperature of the crucible to 1,600 deg. C. in half an hour, and with this temperature once obtained it may be readily maintained with an input of 12 kilowatts. The life of the heating element has been found to be about 50 melts, each melt lasting about one hour with a temperature of from 1,500 to 1,600 deg. C. in the crucible and possibly 2,000 deg. C. or more in the heating coil. It appears that the carbon helix gradually sags while in use. The first sign of deterioration is when the two lower turns come closer together with the result that an arc plays between them. The arc, in turn, causes the next two turns to sag, resulting in a second arc, and so on until the entire coil has lost its shape. In sum, the helix under the influence of the intense heat developed in time loses its shape and becomes valueless. But this is not a point against the design of the furnace, for the carbon coils can be made at a reasonable cost.

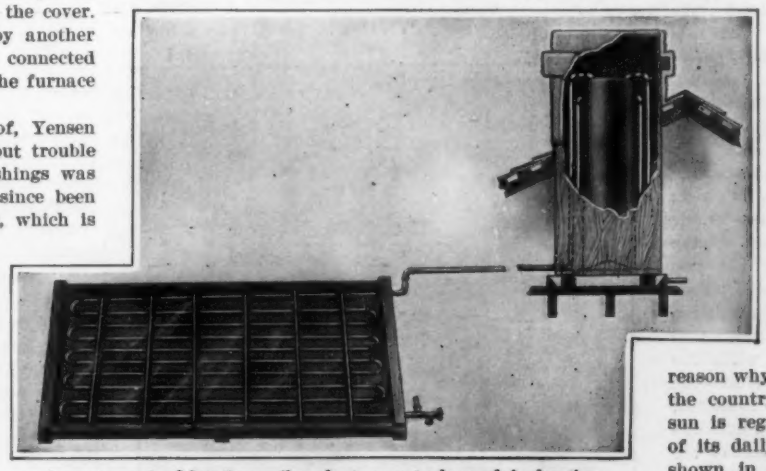


The components of an electric furnace used in vacuum iron research work

Putting the Sun to Work in Supplying Hot Water

THE hot water used by about one half of the residents of Monrovia, Cal., is heated by the sun, and many other establishments, domestic and otherwise, in other localities along the Pacific Coast are at the present time supplied with sun-heated water.

Utilizing the sun's warmth to heat water is a simple expedient. While the sun shines it is made to impart its warmth to water exposed in a coil on the roof or at some other favorable location; and as the temperature of the water in the coil becomes greater than that of the supply source, a circulation is set up and the warmed water moves along through the coils to a storage tank from which it is drawn for use in the bathroom, laundry or kitchen. As the water moves out of the coils it is replaced by other water from the bottom of the tank, which, although somewhat cooler than that just received from the coil, is still quite hot. After two or three passages the water is almost at boiling point.



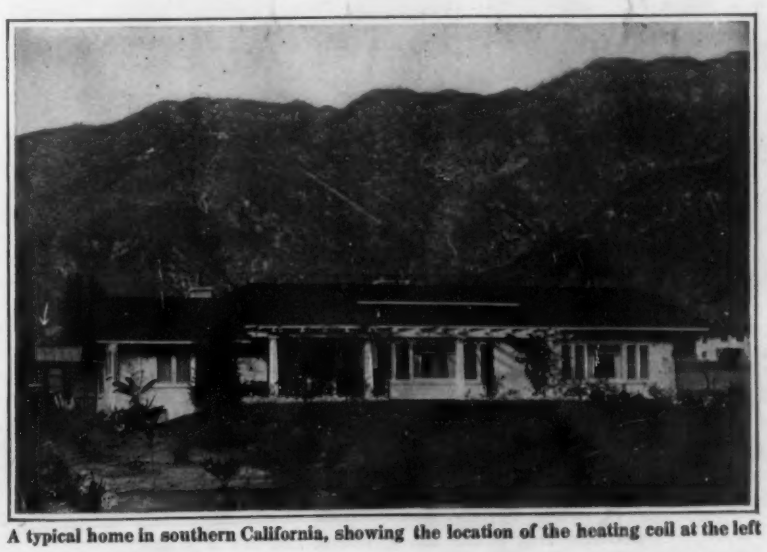
Arrangement of heating coil and storage tank used in heating water by the sun's rays

The tank into which the water passes is so thoroughly insulated that under the most adverse circumstances the loss of temperature by radiation is not more than one deg. per hour and is rarely as great as this. Under ordinary circumstances the loss by radiation is not more than four or five deg. in the course of a night, so that it is possible to draw hot water from the supply system for some considerable time without the sun's assistance. For instance, should the sun refuse to do duty for a day the hot water stored up during the previous day could be drawn upon during a large part of the succeeding day. In case of a succession of sunless days it is customary to fall back upon some auxiliary heating system, such as coal or gas.

The disposition of the necessary tank is sometimes a problem in the installation of one of these systems, for there is not always room about a house of ordinary size for the accommodation of the tank at the required elevation. However, a very ingenious solution of the matter has been made in the form of a false chimney which rests on the rafters and projects through the roof. In the centre of this is a steel tank, and the space between it and the exterior shell of the "chimney" is packed with an insulating material, effectually preventing the escape of the water's heat.

The sun coil, in which the operation of heating the water takes place, consists of a shallow box about four inches deep with a copper bottom; and back and forth through this box is an arrangement of pipes through which the water passes. Copper is selected as it is the best conductor of heat, and the pipes are secured in intimate contact with the copper bottom, being soldered to it so as to secure the greatest efficiency. The box is covered with glass and placed at some point where it will secure the greatest amount of exposure to the sun's rays. Sometimes it is placed on a roof that happens to possess the proper requirements; and again it is utilized as a shelter to a back or side door. Or it may be placed on the roof of a garage or stable.

The California coast seems to be the ideal place for the sunshine water heater, and most of those in use are to be found on the Pacific Slope. But there is no reason why they should not be used in other sections of the country, especially through the South where the sun is regarded as reasonably reliable in the matter of its daily visits. Modifications in the arrangement shown in the adjacent illustration obviously can be made in order better to serve individual requirements.



A typical home in southern California, showing the location of the heating coil at the left

A Measuring Device for Tailors That Insures Perfect Fitting Garments

IN a large measure the success of a garment depends upon the accuracy and thoroughness of the measurements taken by the tailor. While it is true that a suit can be altered considerably after the material has been cut and roughly sewed together, still, the customer is best served if the tailor starts out with accurate and complete data, and the time to secure this information is at the very start.

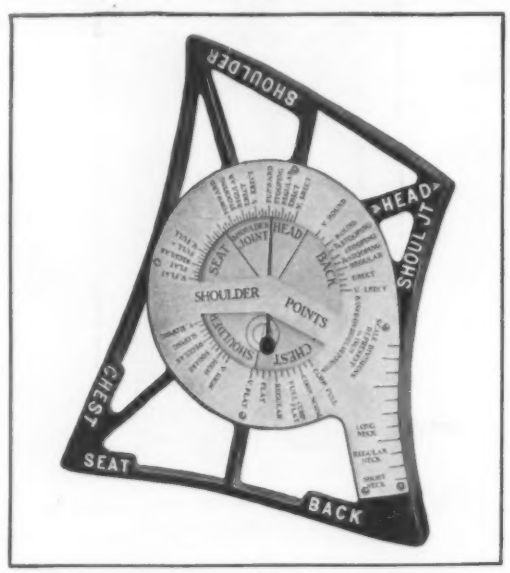
Realizing that the tape measure and other measuring devices now in the hands of the tailor are inadequate in securing the finer details which are necessary for the cutter to know, an American inventor has recently developed a novel device which he has termed the "shoulder points." As will be noted in the illustration of the device, "shoulder points" is a four-sided metal frame, mounting a graduated scale and dial. Each edge is adapted to fit against that member of the body inscribed on it. The indicator in the center of the dial is weighted at one end, causing the other end to always point up, or to the highest point. The division marks on the

dial plate each represent ¼, ½, ¾ or 1 inch from the regular position. For example: The back of the client being fitted may be ¼, ½ or ¾ erect of regular position, or it may be ¼, ½ or ¾ stooping of the regular position, and so on.

The first step in using the "shoulder points" is to have the client stand in his usual standing position, coat off, his weight equally balanced on both feet, and his heels about 3 inches apart. It is highly important that the customer stand at the usual position and not in a forced, erect position. The measuring device is then turned until the indicator points to the name of the member that is in use, the "shoulder points" being held at the opposite edge while placing the edge named the same as that pointed out by the indicator, squarely against that member of the customer's body. Readings are then taken from the indicator dial. The scale is used in taking measurements of the length of the neck.

Among the measurements that can be taken with the "shoulder points" are the position of the head, whether regular, erect or forward; the back, whether regular, stooping or erect; the length of the neck, whether regular, long or short; the shoulder joint, whether regular, forward or erect; the slope of the shoulder, whether square or sloping from regular; whether one shoulder is low and if so how much; the chest, whether regular, full or flat, and the seat, whether regular, full or flat.

Tailor making use of the new measuring device in measuring the slope of the customer's shoulders



A newly invented measuring device for tailors, that permits of accuracy and thoroughness

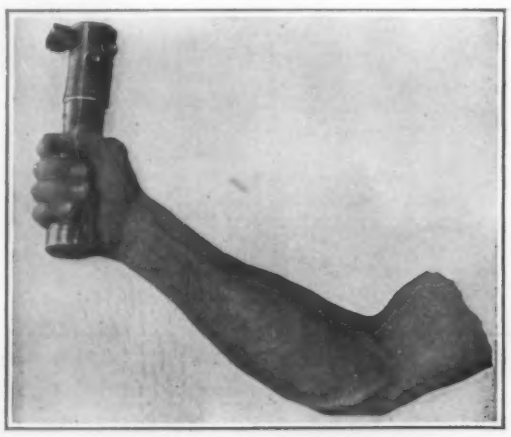
A Pyrometer That Operates on the Principle of Matching Known and Unknown Light Intensities

BY comparing two intensities of colored light, one of known value and the other of a value that is to be determined, a recently developed pyrometer makes possible the measuring of the temperature of a heated body either within or without a furnace. The new pyrometer, although sufficiently compact to be carried about in the pocket, duplicates the color of heated bodies and at the same time indicates the temperature on an accurately calibrated scale in a manner that is about to be described. It is possible for the user to read temperatures to an accuracy of 1 to 2 per cent., regardless of the furnace temperature.

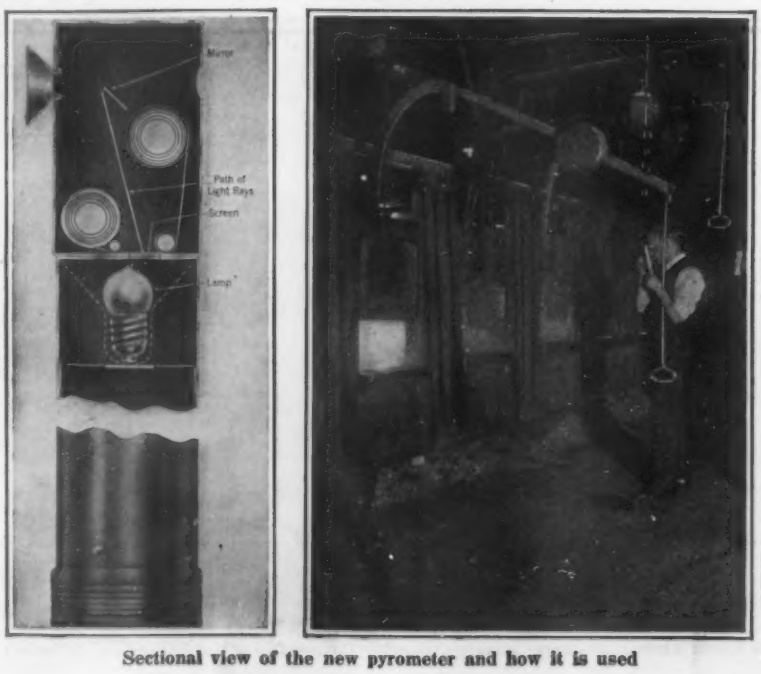
The present pyrometer is especially adapted to the heat treatment of machine parts. As will be noted in the accompanying illustrations, the body under treatment is viewed through the peep hole in the pyrometer which is held with the left hand in such a manner as to facilitate pressing the contact button in front. Upon pressing the button a small incandescent lamp, supplied with current from a battery carried in the case of the pyrometer, throws a beam of light which passes through a screen of varying transparency and impinges on the inclined mirror that is visible when looking through the peep hole. By referring to the sectional view the explanation becomes clear. Two intensities of color are seen when looking through the instrument: first, the one formed by the object being viewed; second, the reflection of the light showing through the graduated screen. While the light is turned on the operator manipulates one or the other of the two knurled knobs at the side, causing the graduated screen to be moved from one roller to the other, bringing a lighter or darker section over the lamp aperture. The upper knob represents a rising temperature, while the other stands for a lowering temperature. When the two colors seen through the peep hole appear to match, a reading is taken with the light still on. The numbers representing the various temperatures form part of the graduated screen and hence appear on the mirror.

The light intensities as viewed through the pyrometer appear as different shades of blue. This color has been chosen for the reason that it lends itself well to making exacting comparisons between various shades. For instance, experiments were recently carried on by Prof. E. L. Nichols of Cornell University to determine the sensitiveness of the human eye and its ability to distinguish shades of color. He placed 92 different shades of blue before 54 observers. The general average for placing these shades in the proper regulation was over 95 per cent. The extent of this sensitiveness is further attested in that in the practice of medicine the amount of hemoglobin in the blood is best determined by the hemoglobinometer, an instrument consisting of a graduated color with a calibrated scale to which is compared a drop of blood. An interesting fact in connection with this experiment is that a man who is color blind can read with the same facility as one who is able to distinguish color, for the reason that while the color may not appear as red or orange, he is still able to duplicate the intensity, even though it appear green or blue.

The present pyrometer is but 8½ inches in length. Its battery will last, in ordinary service, from two weeks to a month, according to the use made of the instrument. New batteries are readily obtainable, since they are of standard size. The pyrometer is made in two ranges, 1,000-1,800 deg. F., and 1,800-2,300 deg. F.



A pyrometer which is based on the comparison of light intensities



Sectional view of the new pyrometer and how it is used

An Industry that Has Grown to Maturity Within the Last Two Years

By John R. Spears

IN addition to the ordinary uses of metallic zinc, there is a very considerable market for zinc dust. The chief demand for this substance comes from producers of gold, silver and copper who use the cyanide process of extracting these metals from their ores. In this process the powdered ore is mixed with a solution of potassium or sodium cyanide. The metal of the ore replaces the sodium or potassium in these salts, giving a gold, silver or copper cyanide; and this, on treatment with zinc dust, suffers a similar break-up. The net result of the entire process is, therefore, a deposit of metallic gold, silver, or copper, and a using up of the zinc, which cannot conveniently be recovered from the cyanide form into which it has passed.

The high price of copper and silver which has prevailed since 1915 has made it possible to work again abandoned deposits of these metals, and has so led to an increased demand for zinc dust. In addition, a new process of galvanizing iron has been developed, utilizing zinc dust in place of the old-fashioned bath of molten metal. Finally, each tiny particle of the zinc dust consists of a heart of pure zinc covered with a film of the oxide. Under favorable conditions this dust will explode spontaneously, and this leads to utilization of the dust as an explosive.

Although zinc dust is necessarily produced as a by-product in every American smelter handling zinc ores, for many years it was not put on the market from this source. As in so many other fields, the Germans maintained a monopoly here by a policy of ruinous underselling whenever home competition was threatened, so that all the zinc dust recovered from the American smelters was returned to the retorts and used to produce spelters.

In 1909 the imports of zinc dust from Germany reached a total of two and a half million pounds. In that year an effort was made to foster an American zinc dust industry by means of a duty of one and three eighths cents per pound; so that by 1914 the American smelters were supplying two million pounds out of a total consumption of six million.

In August, 1914, the European war of course stopped all European exports of zinc dusts; and because American smelters were unprepared to supply the demand promptly, the price rose from six to nineteen cents per pound. But for the tariff of 1909 there would have been none on the market at any price. Later the dust sagged to nine cents per pound; but when the orders for war metals got well organized the demand and the price necessarily went on another soaring expedition. In March, 1915, it was selling at seventeen cents, in June at forty; and even at this figure an export demand had developed. While this demand has been relatively small, the exports for 1915 totaled over four hundred thousand pounds.

Although no reliable figures have yet appeared for 1915 or 1916, a consideration of all increases in demand that have arisen through the various uses of the metal in the form of the dust would indicate that the American smelters will be able to sell this year some twelve million pounds of this material. So that we have here a three million dollar industry developed from nothing in six years, and from a state of decided infancy in two. While it is plain that the infant has reached a vigorous maturity, it is not to be forgotten that the Germans were able to produce zinc dust more cheaply than we could before the war, and will doubtless again do so after it. And then means must be devised to protect the American makers of zinc dust from the same strangulation that is anticipated for so many industries.

Measure Aimed at White-Pine Blister Rust

THE white-pine blister rust has reached a stage where, according to specialists of the United States Department of Agriculture, energetic action is imperative if the disease is to be controlled. Not only is all of the eastern white pine threatened already, but there is little doubt that if rigid state quarantine does not stop it the infection ultimately will ravage the great forests of the west.

The mature white pine in the eastern States is valued at approximately $186,000,000. In the west the mature stands of sugar and western white pine are valued at $240,000,000. In Farmers' Bulletin 742, a new publication of the Department of Agriculture, it is declared that each State west of the Missouri River should prohibit immediately all shipments from the east of 5-needle pines or of currants and gooseberries, which play an important part in the transmission of the disease.

Concrete Piles in Salt Waters

(*Concluded from page* 147)

These piles at Halifax are big fellows, 24 x 24 inches in plan section, so that they are doubtless more or less prepared for pier action.

A little consideration will show one that piles extending a considerable distance above solid material would require lateral bracing in order to prevent swaying and afford substantial resistance to horizontal thrusts from wind and vessels. Diagonal transverse bracing was deemed insufficient to meet the requirements of the case. It was proposed to substitute oblique piles extending from about the pier deck down to the feet of the ordinary vertical piles and to provide against lateral movement by this means. This suggestion has been adopted, and we have here what "is believed to be the first application of such a system of bracing to reinforced-concrete work."

In order to provide against possible chemical action, a Portland cement has been employed in which the maximum alumina content was fixed at 6.3 per cent. This was the lowest percentage, apparently, that the manufacturer was able to supply. The concrete mixture was made very rich indeed. A 1:2 mortar is considered quite rich; but here the concrete formula was 1:1½:3. The grading of the aggregate was given attention in the specifications, with the purpose of producing density of concrete. The piles were cast and matured, and then driven by means of a pile-driver.

Three cushions were employed to separate pile head from hammer. First above the pile was a spruce plank 3 inches thick. Next came a cast-steel follower some 4 feet high. This was a cylindrical shell with upper and lower flanges. A depression was provided on top of the upper flange for the purpose of providing a seat for the third cushion. This last was a hardwood block some 15 inches in thickness and bound round with a band of steel. The hammer blows fell directly upon this block, and their force was naturally transferred to the spruce block, and then to the pile itself.

The need for extraordinary precautions will be apparent perhaps when one considers the cross-section of the piles and the weight and power of the hammer. The hammer weighed 4,000 pounds. With the hammer, follower and guide, the weight on the pile was some 14 tons. It is said that the hammer was estimated to develop, when making 80 blows per minute, 3,916,000 foot-pounds per minute. This double-acting, steam pile-driving hammer is perhaps the very largest ever built. The piles are said to have varied in weight from 12 tons to 46,000 pounds.

The teredo is given the responsibility for the selection of concrete piles for the San Francisco and Machina piers at Havana, Cuba. The depth of water at the site varies from, say, 20 to 40 feet. Beneath the water is 15 or 20 feet of sand or clay. Hard bottom is in some parts far down. The piles required varied from 45 to 85 feet in length, the maximum length being greater than that of any vertical pile at Halifax. They are square in cross-section and not so large as those at Halifax, the length of a side varying from 16 to 20 inches. In general, these piles were designed to withstand horizontal handling. Suspension was made from two predetermined points. It may be said in passing that the necessity for reinforcement of the main body of a precast, pre-matured concrete pile is governed largely by the need for handling. In the present case care was taken that the horizontal suspension during handling should be at the points chosen, and nowhere else. To secure this result, short lengths of pipe were cast in the piles at the desired locations. The handling dogs were inserted in these. The hammer employed weighed 5,000 pounds, and there was a 42-inch stroke.

As another alternative to ordinary wooden piles, the plan of inclosing a cluster of wooden piles in a cofferdam or casing of concrete was considered. But the considerable depth at which hard bottom was to be found caused its rejection.

When the piles were let down, their own weight and that of the hammer were at times sufficient to secure a penetration of 10 or 20 feet. Generally, the piles were driven until a blow secured a penetration of only ⅛ inch. This result was attained in some cases with 200 blows; in others as many as 1,000 were required.

At Halifax the number of blows required varied from, say, 200 or 300 to the neighborhood of 1,800. Out of 1,550 piles driven by the hammer only two were seriously damaged in the head.

Sub-Surface Blockade Running

(*Concluded from page* 151)

the Capes in the presence of a strong and well-equipped blockading squadron.

The simplest and speediest way to get past the enemy would be for the boat to select a dark night between the moons, or one in which vision is interfered with by fog. In this case she could pass out on the surface, cutting out her oil engines to avoid the noise of the exhaust, and running under her electric motors. To make certainty doubly sure she could fill her ballast tanks until she was awash. Under this condition it would be extremely difficult for the searchlights of the enemy to pick her up, and there would not be one chance in a hundred of the submarine running foul of the enemy by accident, or of the enemy sighting so small and inconspicuous an object as a submarine's conning tower.

A glance at the chart which we publish, in which the depths in the channel are shown in feet, shows that if the boat decided to pass out entirely submerged, her captain, because of the limited clearance, would have to navigate with very great care. For it is a fact that the commanders of submarines engaged in the war agree that it is desirable to have a depth of at least sixty feet of water if a submarine is to operate successfully. The British attribute the immunity from submarine attack of their ships which have periodically bombarded Zebrugge, Belgium, to the shallowness of the water off that coast. It requires watchful care to maintain a submarine at a predetermined depth while she is being driven at full speed, and this is particularly true in a seaway when there is what is called a "pumping" action, and the boat, even though it is submerged, is rising and falling with the undulation of the waves above. Hence, when a sea is running and the submarine is in shoal water, she is liable to bump the bottom with sufficient force to start her plating.

Returning to our chart, we see that, within the channel, there are places where the depth of the water is only forty feet, which would give about forty-five feet at high water. From her bottom to the top of her periscope when housed the "Deutschland" measures between thirty and thirty-five feet; from which it can be seen that careful navigation is necessary to carry her out past the Capes in the submerged condition. The thing can be done, but only at slow speed, say about four or five knots. Whether the captain would risk a submerged passage if a heavy sea were running is open to doubt.

Ouside of the one in a hundred chances of sighting the submarine at night, whether she were running submerged or at the surface, there is nothing in the conditions to prevent the German captains from bringing their U-boats in and out of the Chesapeake on any dark or foggy night with impunity. By daytime, of course, the feat would not be so easy; particularly if the enemy cruisers were accompanied by a fleet of fast motor boats and a few hydro-aeroplanes. Even when running submerged, a submarine produces a surface disturbance which can be detected, and once the boat is thus picked up, a group of twenty-five- to thirty-knot motor boats can hang on to her with wonderful certainty and with a very good chance of getting her when she comes to the surface.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel

TRIMMING.—H. BERLIN, care of Berlin & Trosky, 57 W. Houston St., New York, N. Y. This invention has reference to embroidery trimmings as used for millinery and the like, and more especially to imitation straw which is made from silk and the like, and the main object thereof is the provision of an effect or appearance of such straw not hitherto attained.

Electrical Devices

TERMINAL CONNECTOR.—W. C. MAYNARD, Miami, Fla. This improvement provides a connector in which the electric circuit is established directly between the conductor and terminal by direct contact thereof without the intermediary of the connector as a conducting medium, the arrangement being such that the sole office of the connector is to clamp the conductor and terminal in direct contact with each other.

Of Interest to Farmers

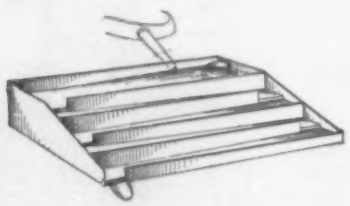
SEED SEPARATOR.—H. J. PIEPGRAS and B. M. HOLT, Caldwell, Idaho. This improvement relates to seed separating machines, especially designed for separating weed seeds from grass seeds, the separation being carried out on the principle of dissimilarity of shape and surface of the seeds to be separated rather than the size of the seeds.

PROCESS FOR MAKING FODDER.—B. R. RENSHAW, Ames, Iowa. The invention relates to a process of treating cellulose materials rich in pentosans, such as corn cobs, cereal straws, sugar beet residues, sugar-cane stalks, or similar materials for the purpose of improving their digestibility and palatability to animals, and also to reduce the tendency of such materials to injure the mouth of the animal.

COMBINATION HARROW AND CULTIVATOR.—F. M. VERMILION, Shattuck, Okla. This device is adapted for the simultaneous pulverization and cultivation of the soil, and wherein mechanism is arranged so that it may be shaped to fit the character of ground over which it is traveling, that is to move within a furrow with the cultivating mechanism cultivating at the same depth in the bottom of the furrow and on the sides.

COTTON GIN.—W. G. DERAMUS, Montgomery, Ala. The mechanism is for use for more thoroughly removing the lint from the seed, wherein a drum is provided, having on its periphery a coating of emery, together with a cutter of metal, and curved to fit the periphery of the drum, to bring the seed into close proximity to the coating in order that the coating may grasp the lint, and wherein the means is provided for permitting the cutter to be adjusted with respect to the drum, and wherein other mechanism is provided for cleaning the lint from the drum.

COOLER.—S. S. STORY, Pawling, N. Y. This device is simple, practical, thoroughly sanitary, easily cleansed, and very inexpensive. An object is to dispense with the use of pipes, coils, blowers, fans, sleeves, and pumps, as are now employed in different types of



COOLER FOR MILK, CREAM, ETC.

coolers, and further to provide a device wherein the fluid is subjected to the influence of the cooling medium over a relatively great travel through the device.

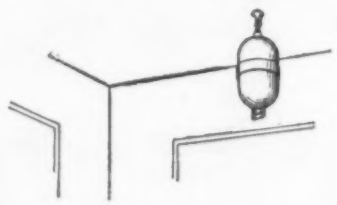
FEEDING DEVICE.—W. M. HARTT, Great Falls, Mont. The primary object here is to provide a device wherein means are provided, in the form of medicated pads, for preventing the spread of diseases prevalent among poultry, said pads being so arranged that the feet and heads of the fowls, when feeding, will come into contact therewith.

Of General Interest

FORM CLASP.—J. S. MURPHY, 355 16th St., Brooklyn, New York, N. Y. This invention relates to molds or forms employed in concrete construction work; and its purpose is to provide a new and improved form clamp arranged to securely connect the sides of the mold with each other and to prevent the same from spreading when filling in the concrete.

PROCESS FOR THE PRODUCTION OF RESINOUS MATERIALS—CAMILLE GRANEL, Bouscat par Lesperon, Landes, France. This invention has for its object a process for the extraction of resinous materials contained in the residues of the distillation or purification of pine tappings or turpentine. On treating the residues direct from the purification of these tappings the invention obtains a much greater output of the dry materials contained in the residues with the production of pitch of a brighter color.

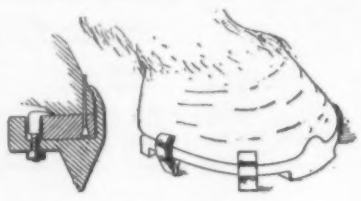
AUTOMATIC PORTABLE FIRE EXTINGUISHER.—J. C. SNACKENBERG, 282 Kosciusko St., New York, N. Y. This invention refers particularly to an automatic portable fire extinguisher, and has for an object to provide a container and means for distributing a fire extinguishing fluid therein. An-



AUTOMATIC PORTABLE FIRE EXTINGUISHER

other object is to provide a portable extinguisher arranged to be released by heat whereby the extinguishing fluid is applied in the vicinity of the heat which sets the device in operation. The extinguisher is adapted to be hung in any position at any desired point.

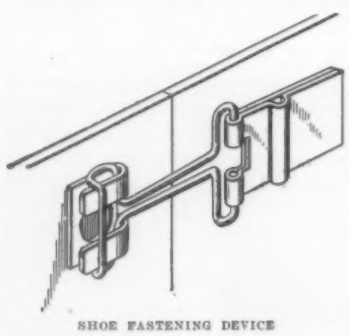
DETACHABLE HORSESHOE CALK.—W. B. HILL, 2137 7th Ave., New York, N. Y. The invention refers to farriery and has particular reference to anti-slipping devices for horseshoes. It provides horseshoe calks of a nature readily applied or removed, which may be carried by the driver or vehicle, ready for ap-



DETACHABLE HORSESHOE CALK

plication at any time by the use of a small tool, such as a screw-driver or wrench, and when applied will remain in place until their removal is desired, the application of the calks being directed to the usual standard shoes, which may or may not be provided with calks.

SHOE FASTENING DEVICE—R. V. SAMPSON, 1643 Champs St., Denver, Colo. This invention has reference to a metallic fastener

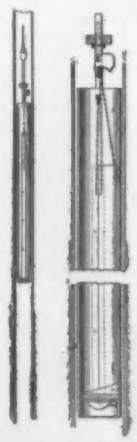


SHOE FASTENING DEVICE

for shoes, to close the opening therein. The objects of the invention are to produce a fastener for the indicated purpose, improved in various particulars with respect to strength and simplicity, and to the end that secure fastening, as well as the unfastening of the shoe, may be effected with facility and dispatch. The device is adapted to fastening automobile and carriage curtains, and leggings.

Hardware and Tools

APPARATUS FOR PLUGGING WELLS.—C. E. SITZMAN, care of Standard Oil Co. (Section 10), Taft, Cal. This invention has particular reference to apparatus employed for plugging oil wells at the bottom thereof. Several causes, as for instance, water and sand

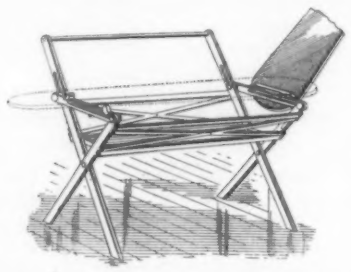


APPARATUS FOR PLUGGING WELLS

entering a well casing, render it necessary to plug the bottom of the well to stop such ingress. One method is to drop, by hand, into the top of the casing the material used, such as stone, brick, lathe cuttings, lead wool, old rope and concrete. Owing to the nature of this material, it often becomes clogged in the well casing before reaching the bottom thereof, which necessitates the use of suitable tools to loosen the material. The present invention overcomes the above difficulties.

Household Utilities

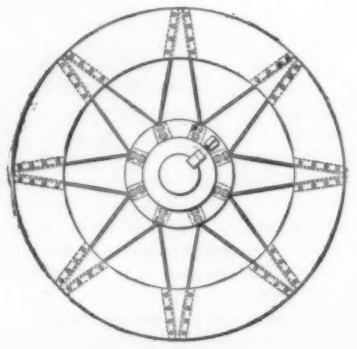
COMBINED FOLDING IRONING BOARD, CLOTHES BASKET, AND CLOTHES RACK.—C. W. KETTLER, 2501 Vance Ave., Warwood, W. Va. In this case the invention is an improvement in a combined folding ironing board,



COMBINED FOLDING IRONING BOARD, CLOTHES BASKET AND CLOTHES RACK

clothes basket and clothes rack, and the object is to provide a device which may be collapsed into a folded position for storage or transportation, or expanded into a condition for use, which may be converted at will into an ironing board and a support therefor, or into a clothes basket, and which in either form has in connection therewith a rack for the clothing.

FAN WHEEL.—G. F. SHERWOOD, Jacksonville, Fla. The inventor has for his object to provide a wheel that will be reversible and interchangeable and free from projections of any character, as for instance, rivets or lugs



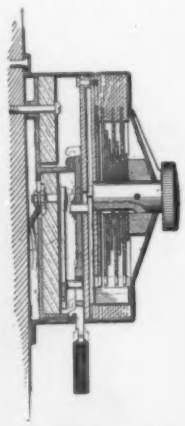
FAN WHEEL

that might come in contact with the material to be handled and which can be reversed to compensate for wear and to insure that the opposite sides of the beaters will wear evenly and uniformly.

Machines and Mechanical Devices

CENTRIFUGAL PRESSURE FILTER.—F. K. ATKINS and E. F. ATKINS, 165 Broadway, New York, N. Y. This invention relates more particularly to filters of that type disclosed in U. S. Letters Patent 980,859, formerly granted to the inventors. A specific object of the improvement is the provision of a filter having a bowl rotating on a vertical axis and supported in bearings underneath the bowl and having a supply conduit discharging axially into the bowl from the top.

COMBINATION SWITCH LOCK.—J. H. JEFFRIES, Route 2, Box 93, Inglewood, Cal. The invention relates particularly to combination locks and switches for motors for vehicles and boats. In starting motors it is customary



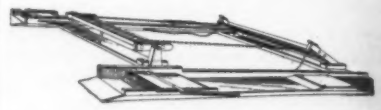
COMBINATION SWITCH LOCK

to turn the switch to the battery for preliminary sparking, and then, when the motor is running, it is switched to the magneto. It is also desirable at times to lock the parts in such position that the motor cannot be tampered with or operated by a person other than the owner or an authorized employee, when the owner or driver leaves the vehicle in a public thoroughfare for any purpose, and hence the machine cannot be stolen or used surreptitiously.

PULVERIZING MILL.—M. R. O'SHAUGHNESSY, Cobalt, Ontario, Canada. The results in this invention are attained by means of a plurality of casings forming a unit rotatably mounted and provided with a relatively small inlet at one end, a relatively large outlet at the other end, and openings between the casings successively increased in diameter from the inlet to the outlet ends, whereby the altitude of said inlet, openings, and outlet are successively decreased from the inlet to the outlet ends, and certain radial convolutions may also be used in the casings which increase outwardly in depth.

Pertaining to Vehicles

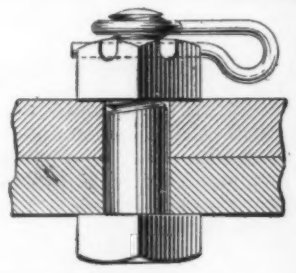
AUTOMOBILE LIFTING APPARATUS.—R. KRAUSE, Belhaven, N. C. This invention provides novel mechanism for raising an automobile off its tires when the same is stored in a garage so that the effectiveness of the tires is prolonged and such mechanism includes a base frame in which are pivotally



AUTOMOBILE LIFTING APPARATUS

mounted front and rear vehicle supporting frames normally in a tilted position, said front frame being adapted to be engaged by the front axle of the vehicle and swung to a substantially vertical position whereupon the rear frame will be actuated in a like manner.

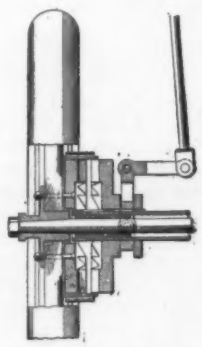
COTTER PIN.—J. O. KAFADER, Fort Bidwell, Cal. This cotter pin is for use in connection with bolts and nuts, and the object of the invention is to provide a pin having improved self-locking means, possessing ad-



COTTER PIN

vantages over the usual split cotter pins. The invention has largely in view to provide a cotter pin especially useful on automobiles for securely locking the nuts, which may be applied to the bolts and nuts and removed therefrom with convenience and despatch.

SAFETY BRAKE CLUTCH AND LOCK.—W. H. SWOYER and J. W. HORNER. Address Harvey Christman, Linfield, Pa. This improvement pertains to safety appliances for wheeled vehicles and has particular reference to a positive brake attachment for a vehicle wheel. It provides means whereby in the



SAFETY BRAKE CLUTCH AND LOCK

event of the failure of the usual friction brake devices to avoid danger, a positive stop coöperating with the brake or hub portion of the wheel is provided, the same acting either independently of or auxiliary to the usual friction brake.

BACK REST FOR SEATS.—H. W. WEED, 21 4th St., Stamford, Conn. Mr. Weed provides a back rest for seats such as the saddles of bicycles, motorcycles, or the like, such back rests being movably connected to the seat frames or supports so that they may be swung downwardly out of the way for mounting upon or dismounting from the seats.

VEHICLE WHEEL.—C. F. ERICKSON, 374 Greenwich Ave, Greenwich, Conn. The improvement refers to vehicle wheels, and more particularly to the resilient, non-pneumatic class of wheels. It provides a simple, strong and inexpensive vehicle wheel which is characterized by a resilient rim connected to the hub by pliable non-resilient spokes.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

The Munitions Explosion in New York Harbor

(*Concluded from page 150*)

cars not a vestige is to be seen—the fragments have scattered or have been driven deep into the earth fill and underlying mud of the harbor. The adjacent cars, mostly of steel, are wrecked and twisted into fantastic shapes. The surrounding sheds and warehouses were thrown down in utter ruin.

The vast atmospheric wave created by the sudden generation of this enormous volume of gases swept over Jersey City, Manhattan and Brooklyn with terrifying effects upon the sleeping citizens and with disastrous results to the plate-glass windows, which were first bent inwards by the pressure of the air-wave, and then, rebounding, were sucked out of their frames by the following vacuum and thrown into the streets.

The first effect noticed by those who were awake was the severe earth shock which traveled through the surrounding cities. This was followed a few seconds later by the boom of the explosion.

There has been the usual panic talk—much of it extremely foolish—which always follows a disaster of this character. Instead of trying by legislation to prohibit the shipment of munitions via New York, the sensible thing would be to recognize that the trifling loss of life and property (trifling in view of the magnitude of the explosion) proves how excellent are the laws governing the shipment of explosives at the port of New York. If these laws can be bettered, well and good; but it would be the very height of folly to drive this very considerable trade to rival ports, which after the war will be certain to make every effort to maintain the advantage so gained.

NEW BOOKS, ETC.

ALL THE WORLD'S AIRCRAFT. 1916. Founded and Edited by the late Fred T. Jane. C. G. Grey, Technical Editor. London: Sampson Low, Marston & Co., Ltd. 4to.; 263 pp.; illustrated. Price, 21s. net.

Many delays and discouragements attended the compilation of the seventh issue of this well-established annual, culminating in the sudden death of Mr. F. T. Jane, to whom we are indebted for the naval war game, and whose writings on naval subjects will be familiar to most of our readers. It is a pleasure to be able to testify that this final labor of Mr. Jane's proves to be well worth waiting for. It begins with a glossary of technical terms, and gives their equivalents in six languages. Part A presents aeroplanes and dirigibles, arranged alphabetically by nationalities; this section includes many striking illustrations of representative types, briefly describes them, and gives, whenever possible, the number and kind possessed by each nation, with a list of aviators; aeronautical societies, journals, and schools are frequently appended. There is much information regarding Teutonic flying strength and organization, but this naturally applies mostly to conditions existing before the declaration of war. Part B pictures the aeroplanes of the past; many sheer freaks are here exhibited, but among them may be found conceptions that were the forerunners of the aeroplane of to-day. Part C aims at being a complete list of all practical and efficient aero engines, but late details are often unobtainable, owing to the restrictions made necessary by the war.

SMALL BOAT NAVIGATION. By Lieut. Com. F. W. Sterling, U. S. Navy (Retired). New York: Outing Publishing Company, 1916. 16mo.; 148 pp.; illustrated. Price, 70 cents net.

The popularity of boat building as a hobby will probably never wane. Every cut of the saw and stroke of the hammer not only imparts a peculiar pleasure at the time, but brings to mind the enjoyment to come when the craft shall have taken the water. By a study of the instructions and diagrams given in "Small Boat Building" time-consuming errors may be avoided, material can be ordered and used economically and advantageously, and the completed boat is much more likely to be staunch and well-made. Only such boats as come within the amateur ability are considered, and hull construction only is dealt with. In "Small Boat Navigation" we are made familiar with the instruments and books of this science and with the principles of piloting, dead reckoning and nautical astronomy. The light and buoy system explained, some knowledge of weather is imparted, and the rules of the road are cited at some length. All the information is couched in simple language, and the work may be unhesitatingly commended to the amateur seaman.

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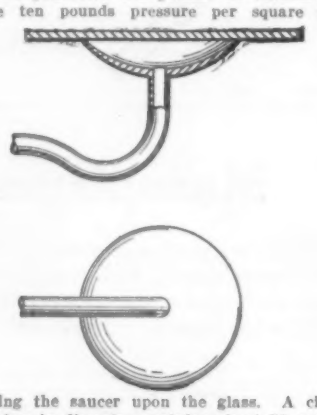
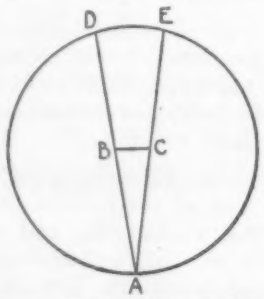
Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(14136) R. W. C. asks: I have a round, disk shape, bowl or saucer connected with a vacuum pump and gauge. The edge of saucer has a rubber ring to make vacuum tight. Saucer 8" diameter. When I put this on a hard surface like plate glass and have ten pounds vacuum on gauge, how many pounds will the device lift before coming off? If I place it edgewise with same amount of vacuum, how much weight will it lift before coming off? A. If you have ten pounds of vacuum you have ten pounds pressure per square inch



holding the saucer upon the glass. A circle 8 inches in diameter contains about 50 square inches, and the pressure upon the circle will be about 500 pounds. The device will lift somewhat less than 500 pounds. With such a weight at such a pressure air will soon leak in and the weight will drop off. If placed edgewise it will not lift very much, since the device will slip upon the glass. We have no way to tell what the friction will be and how much it will lift.

(14137) C. and U. asks: Will you please prove to us the reason why the top of a wheel goes faster than the bottom of same? A. The word "Go" has many senses. In one sense the top of a wheel does not go any faster than any other part of the wheel. When the wagon has gone a mile the whole wheel has gone a mile. In the sense of rotating around the center of the hub the whole wheel goes round with the same speed. But in the sense of forward motion along the road, the point of the wheel which at any moment is in contact with the road is at rest. That point is not moving on the road at all unless it is slipping along, which a well-behaved wheel does not do. The top of the wheel is at the same moment moving forward. It can be seen that the top of the wheel does not come to rest at all. It can be seen that the bottom of a wheel does come to rest on the road. Make a chalk mark on the rim of a wheel and



watch it come down to the road and rise up again. You can see that the chalk mark has no forward motion for an instant. It comes down, stops and rises again. Now look at the hub and compare its forward motion with that of the top of the wheel. You can soon discover that the top is moving forward faster than the hub. In fact, it is moving forward twice as fast. If you will draw from the ground a line sloping slightly backwards and another from the same point sloping slightly forwards you will see how it is that the top of a wheel moves faster forward than the hub moves. It is evident from the figure that A is a point where the wheel does not move for an instant on the ground, while B-C is the motion of the hub in a brief interval of time and during the same time D-E is the distance the top of the wheel moves, and that D-E is twice as long as B-C.

(14138) F. A. W. asks: Do you know of any pecuniary reward offered for the solution of the Gyroscope? A. There is no reward offered for the solution of the motion of the Gyroscope. We can furnish you with Crabtree's Spinning Tops and Gyroscopic Action, price $2.25; and Cordeiro's Gyroscope, price $1.50. These will give you the mathematical solution, which is what is required by scientific men.

(14139) G. C. S. asks: Sometime ago you published a very interesting article in regard to fuel economy in which a mixture of benzole and alcohol were mentioned. Will you kindly inform me as to the difference between benzole and ordinary gasolene? A. Benzole is a definite chemical compound, known also as benezene. It has the formula, C_6H_6. It is a coal tar product. The name benzine and gasoline are often applied to the same substance. They have no definite chemical formula, but are prepared by the distillation of crude oil, and have a low boiling point. Kerosene is the product which has the next higher boiling point to gasoline. The lubricating oils, vaseline and paraffine have still higher boiling points. They all are separated from crude petroleum by distillation. They come off in succession as the temperature in the still rises.

(14140) W. B. B. asks: I have just found in Cajori's History of Physics a statement to the effect that the doctrine that the atmosphere keeps the earth warm in the same way as does the glass of a green-house—by absorbing the infra-red radiation of the earth—was disproved by Langley's experiments. "The infra-red rays pass through with comparative ease." Instead, the atmosphere keeps back an immense proportion of the blue and green. As a high school teacher of physics, I got this statement (which Langley disproved) from somewhere, and have been telling my classes that it is the way in which the atmosphere keeps the earth warm, and that it accounts for the earth being warmer at lower altitudes. Assuming that I am wrong, and that Cajori is right, what is the explanation—how does the atmosphere keep the earth warm, and why is it warmer at lower altitudes? Why does not the atmosphere keep out as much heat as it keeps in (2) I have seen the statement that a blackened thermometer shows a higher temperature on a mountain top than at the base, and I thought the explanation of that was the same. Will you please set me right? A. You will find in Moore's Descriptive Meteorology, page 81, and on, the subject of Radiation in the atmosphere treated in its modern form. We send the book for $3. The idea that the air acts as a trap to catch and hold heat allowing the long waves to enter, but not to escape, is not generally believed at the present time. Dust and water vapor prevent the escape of heat from the air, so that frost does not form on a cloudy night as easily as on a clear night. The heat of the earth is not radiated so rapidly into space on a cloudy night as on a clear night. This is a matter of common knowledge. The earth in the year radiates all the heat received from the sun, else it would grow hotter as time passes. The atmosphere does not keep the earth warm. The sun keeps it warm. The passage of radiation, heat, through pure clear air is greater than through moist and dusty air. For this reason a mountain top is colder than the valley below. For this reason a thermometer would be raised to a higher degree on the mountain top than in the valley if it was covered by lamp black which would increase its absorptive power.

(14141) W. B. I. asks: Will you kindly settle the following argument? "A" and "B" had an argument relative to noise. "A" said that there was no noise unless there were ears to hear, while "B" stated that there was noise whether there were ears to hear or not. "A" stated in the argument that the waves of air on the ear drums produced the noise. "A" further stated that if a hammer was struck on a piece of iron there would not be any noise where the hammer hit, but that the noise would be in the ear. A. There are two distinct meanings to the word "Sound": one, the sensation produced in the brain; the other, the external vibration which produces the sensation. The physical cause may exist where there is no ear; the sensation cannot exist unless there is an ear to hear it. Suppose two men, one totally deaf, the other with a normal sense of hearing, are in the same closed room in which a third man beats upon a piece of iron with a hammer. Is there no physical vibration because the deaf man cannot hear it? The sensation may be ear-splitting to the one and totally non-existent to the other. The same vibrations beat through the air. The same sound exists in the room, but the sensation exists for only one of the men.

(14142) G. S. P. asks: Can you tell me, a subscriber, how large burning glasses or lenses have been made, and how great a heat has been obtained by their use? A. The largest lense is that of the Yerkes telescope of the University of Chicago. It is 40 inches in diameter. The heating power of this lens is in the same ratio as its light-gathering power, which varies as the square of its diameter. As compared with a lens one inch in diameter this lens will have 1,600 times the heating power, if losses are not regarded. Lenses in combination, and mirrors, have been made which softened the most refractory substances, so that a temperature of several thousand degrees was realized. Of this there was no exact determination possible at that time. The largest mirror is that under construction for the Mt. Wilson observatory. It is 100 inches in diameter.

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